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HIGH LEVEL ADVICE ON THE DEVELOPMENT OF HERBAL BASED R & D
PROGRAMME FOR INDUSTRY

SI/SRL/96/802/11-51/0730AO

SRI LANKA

Technical report *

Prepared for the Government of Sri Lanka
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of D.V. Singh - Agronomist

Project Manager: T. De Silva - Chemical Industries Branch

United Nations Industrial Development Organization
Vienna

* This document has not been edited

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ABBREVIATIONS

- BMARI -** Bandaranaike Memorial Ayurvedic Research Institute.
- CISIR -** Ceylon Institute of Industrial and Scientific Research
- NARESA -** Natural Resources, Energy and Science Authority of Sri Lanka

ABSTRACT

The short term mission (0.5 m/m) pertaining to the project entitled 'High level advice on the development of herbal based R & D programme for industry' (Project No. SI/SRL/96/802) was undertaken from 26 August to 6 September 1996, with the objective of assisting in the setting up of a goal oriented R & D programme to promote the phytopharmaceutical industry in Sri Lanka by developing expertise in agrotechnology for the production of value added herbal preparations.

Sri Lanka because of its rich flora and varied agroclimatic zones has a vast potential for exploitation of medicinal and aromatic plants through a home garden cultivation system as well as a large scale cultivation system. However, at present there is almost no commercial cultivation of medicinal and aromatic plants in the country except for the cultivation of a few medicinal plants in home gardens and the cultivation of *Cymbopogon nardus* on a large scale in the southern province of the country. This happened due to lack of scientific efforts as the institutions engaged in work on these crops have no staff to take up work on agrotechnology development.

An action oriented plan has been suggested which comprise of (i) Selection and identification of plant species (ii) Domestication of important crops (based on national priority) (iii) Development of agrotechnology of potential crops for which preliminary work has already been done (iv) Crop improvement programme on the crops which are already under cultivation for maximizing economic returns (v) Introduction of promising exotic medicinal and aromatic plants (vi) Development of medicinal and aromatic crops based cropping systems and (vii) Utilization of wastelands through cultivation of suitable medicinal and aromatic plants.

The necessity is being felt that CISIR should take immediate steps to procure at least 5 hectares of farm land around Colombo for field trials on agrotechnology development. CISIR should also have a separate division of Agriculture Science. To start with a senior Agronomist/Consultant and a few junior scientists should be recruited.

1. INTRODUCTION

Sri Lanka, a tropical Island in the Indian Ocean possesses infinite variety of biotic resources and is endowed mostly with productive lands. By virtue of its location and topography, the country is comprised of (i) the wet zone (the south west sector and the part of hill country) with an average annual rainfall of 2540 mm and an average annual temperature of 26 ° C, (ii) the dry zone of the north and east with heavy rains in north-east monsoon (November-February), annual rainfall less than 1875 mm and average temperature between 29-35 ° C and (iii) the hill country with annual rainfall between 1400-2500 mm and average day time temperature 21° C (Kandy) and 14 ° C (Nuwara Eliya). In addition some have identified as intermediate zone between wet and dry zones. This variation in agroclimatic zones suits a wide variety of crops.

In spite of the country's favourable conditions because of different vegetational zones to produce medicinal plants, at present, approximately 900 metric tonnes of 95 different kinds of medicinal herbs or other products are imported to Sri Lanka under the Government subsidized scheme alone spending more than Rs.300 million annually (Department of Ayurveda 1993-94). In addition collection of most of the commercially used medicinal plants from the wild sources has resulted in the disappearance of some valuable species.

Keeping in view the above mentioned facts there is an utmost necessity for the systematic cultivation of medicinal and aromatic plants (i) to ensure the regular supply of raw material to the industries of local indigenous medicines (ii) for export of herbal drugs (iii) to conserve valuable resources of endangered plant species (iv) creating more employment in rural sector by diversifying the traditionally developed agriculture sector in the country (v) to open up new business ventures for the production of medicinal preparations, with added value. For the success of the programme, the remedial measures for the constraints such as (i) lack of trained personnel and other infra-structural facilities on agrotechnology development to provide information on cultivation practices (ii) unavailability of planting material for high yield and desired quality and (iii) unsatisfactory plant identification, need to be undertaken.

All three organizations (CISIR, Export Agriculture Research Station, Matale and BMARI) engaged in work on medicinal and aromatic plants in Sri Lanka have no staff to take up a programme on agrotechnology development of medicinal and aromatic plants. CISIR may play a vital role in bringing the important medicinal and aromatic plants in systematic cultivation in the country to cater to the need of raw material for the industries if it could be strengthened in terms of both scientific manpower & infrastructure facilities for agrotechnology development of these crops as proposed in this report.

The management of CISIR has recognized that the approach and facilities of the Institute need new inputs to meet the challenges to expand the plant based industries in Sri Lanka. In view of this, CISIR requested UNIDO to render assistance by advising on the initiation of an appropriate action oriented R & D programme for the phytopharmaceutical industry (see Job description in Annexure 1).

Almost all of the original objectives of the mission were achieved by detailed discussions with staff of a number of Government and Private Institutions/Organizations, observation of their R & D work and facilities, as well as visits to State and Private factories, field stations and herbal gardens/farms. The consultant has formed a clear understanding of the R & D work being carried out at CISIR to promote cultivation of medicinal and aromatic plants in Sri Lanka and its interaction with outside bodies but lack of infrastructural facilities with CISIR in the field of Agrotechnology development did not permit demonstration of improved methods of cultivation of medicinal and aromatic plants. On account of realizing the importance of production of essential oils in Sri Lanka during discussions with counterpart staff and administrative personnel at CISIR (Annexures 2 & 3), the aromatic plants were also included in action oriented plan.

2. ACTIVITIES

The Consultant arrived in Colombo, Sri Lanka on 26th August, 1996. During the period of stay in Colombo, the Consultant had discussions with his counterpart officials, other scientific and technical staff of CISIR in the related field, administrative personnel of CISIR, Director General of NARESA, officials of Export Development Board and Assistant UNDP Resident Representative.

Considerable time was spent in discussion with counterpart personnel at CISIR to acquaint himself with the R & D work in Agronomy of medicinal and aromatic plants carried out presently at CISIR including the problems and constraints faced with respect to systematic cultivation of medicinal and aromatic plants.

During his stay in Sri Lanka the Consultant has been on field trips to visit a large scale cinnamon cultivation at Meethiyagoda, Export Agriculture Research Station at Matale, Botanical Garden at Peradeniya, Field Station of CISIR (part of the Mahaweli Development Programme) at Girandurukotte, Ayurvedic Herbal Garden of the Ministry of Indigenous Medicine at Haldumulla, Pine Oleoresin production factory of Conifer Products Processing (Pvt) Ltd., at Nugathalawa. The consultant also visited BMARI, Link Natural Products (Pvt) Ltd. and some other organizations. List of people met and Institutions visited are given in Annexures 2 and 3 respectively.

3. PRINCIPAL FINDINGS

Having visited CISIR and other Organizations working on R&D of medicinal and aromatic plants, considering the varied agroclimatic conditions, soils, rainfall distribution and other weather parameters, richness of flora in the country, internal consumption for Ayurvedic Preparations and Pharmaceuticals, network for export promotion, the consultant is of the firm opinion that the country has vast potential for exploitation of medicinal and aromatic plants through a home Garden Cultivation System as well as large scale cultivation.

Some preliminary work has been carried out to explore the possibilities of cultivation of few selected Medicinal Crops - *Cassia angustifolia* (introduced from India), *Piper longum*, *Solanum xanthocarpum*, *Withania somnifera*, *Aloe vera*, *Gloriosa superba* and *Catharanthus roseus*) in CISIR, Colombo and on Aromatic Plants-*Cymbopogon nardus* and *Cymbopogon flexuosus* at the Export Agriculture Research Station of the Department of Export Agriculture at Matale.

BMARI is having a small Medicinal Plants Garden (17 acres) near the Institute in which the major plants used in Ayurvedic system of medicines are being grown. The Institute belongs to the Department of Ayurveda and comes under the Ministry of Indigenous Medicines. The Department of Ayurveda has four herbal gardens at different locations of the country namely Haldumulla (large farm), Pattipola, Girandurukotte and Pattikolle. Effective Scientific efforts have not been made to develop the Agrotechnology for crop improvement even of the plants which are used in large quantities in the country in the preparation of Ayurvedic medicines. The facilities on the farms (including technical personnel) are inadequate for their proper functioning and maintenance. Some exotic plants have been introduced (mostly from India) and a large number of plants have been domesticated from the natural habitat of Sri Lanka on these farms.

At present, there is almost no commercial cultivation of medicinal and aromatic plants in the country except for the cultivation of few medicinal plants such as *Aloe vera*, *Solanum xanthocarpum*, *Piper longum* in home gardens and the cultivation of *Cymbopogon nardus* at a large scale in the Southern Province of the country.

The cultivation of *Cymbopogon nardus* also, is not economical to the farmers because of the fact that no R&D work has been done to reduce the cost of production through Development of Agrotechnology including crop improvement.

Three institutions namely CISIR, Department of Export Agriculture through its Export Agriculture Research Station and Department of Ayurveda through BMARI are engaged in work on medicinal and aromatic plants and all the three organizations have almost no staff to take up the agronomical studies of these crops including domestication, adaptation and evaluation of indigenous crops, introduction of exotic crops, development of agro technology including Seed Biology, Nursery and Planting Management, Scheduling irrigation, Fertilizer management, Weed Management, Harvest Management and medicinal and aromatic crops based cropping systems (for land use efficiency), Plant Protection, Crop improvement through conventional and modern approaches of Plant Biotechnology, micropropagation of high value improved planting material (both in terms of yield and quality) for large scale cultivation.

At CISIR, there is no agronomist to take up the field trials on various agronomical aspects. There is only one staff member as a Senior Research Officer who is qualified in Plant Biochemistry (Production of secondary metabolites using cell culture). At present, a Tissue Culture lab is being developed by the senior scientific officer with very limited facilities. There is no staff to assist the senior scientific officer. In addition the senior scientific officer is engaged in many other activities of the institute for liaison with other organizations being the only agriculture graduate involved in such type of work of the Institute.

The CISIR has no research farm at Colombo to take up the R&D work on development of agrotechnology of medicinal and aromatic plants. The farm allotted to CISIR by the Mahaweli Development Authority at Girandurukotte for agricultural work is about 150 km away from the Institute which for day to day activities is looked after by only a skilled labourer and the CISIR officer is visiting this farm hardly once in a month. In addition there are no other infrastructure facilities (farm implements, net house, farm sheds etc.). Under such conditions, a programme on the development of agrotechnology of medicinal and aromatic crops cannot be undertaken and monitored effectively.

No crop improvement programme (except on selections) has been undertaken through conventional breeding and modern biotechnological approaches on medicinal and aromatic crops in general and spice crops in particular by any of the organizations the consultant visited in Sri Lanka.

The consultant while visiting the manufacturing units of Ayurvedic medicines both in public and private sector came to know that there is always a shortage of plant raw material. The plants which are available in Sri Lanka, are also imported from India, Nepal and Pakistan mainly because of the lack of R&D efforts for bringing these plants into cultivation. The other plants which are not available in Sri Lanka may also be introduced and commercialized to fulfil the demand of the manufacturing units. The Agro Food Technology Division of the CISIR has adequate facilities to carry out analysis of soil and plant samples.

4. CONCLUSIONS

There is vast potential for the exploitation of medicinal and aromatic plants through home garden cultivation systems as well as large scale cultivation. In spite, there is almost no commercial cultivation except for the cultivation of few medicinal plants (*Aloe vera*, *Salanum xanthocarpum* and *Piper longum*) in home gardens and of *Cymbopogon nardus* on large scale in southern province of the country. The cultivation of these crops has also become uneconomical because of lack of R & D efforts. Effective scientific efforts have not been made even to develop the agrotechnology of the crops which are available in Sri Lanka, and bring them under cultivation to cater to the needs of pharmaceuticals and Ayurvedic preparations.

CISIR has no research farm near the Institute at Colombo to carry out field trials on development of agrotechnology of medicinal and aromatic plants. The farm allotted to the CISIR by Mahawelli Development Authority at Girundukotte, is about 150 km away from the Institute and is also under resourced in terms of infrastructure and man power facilities. The programme on development of agrotechnology can not be effectively undertaken under such situation. The services section of Agro Food Technology Division of CISIR however, has adequate facilities for soil and plant analysis.

CISIR and other institutions (Export Agri. Res. Station and BMARI) engaged in work on medicinal and aromatic plants have no staff to take the work on agrotechnology development of medicinal and aromatic plants. There is an utmost necessity to have a separate department on Agriculture Science/Agrotechnology development in CISIR. A Senior Agronomist (Coordinator/Head of Division) or Consultant and a few Junior Scientists in different subjects should be appointed for the proposed action oriented R & D plan.

5. RECOMMENDATIONS

There are about 170 medicinal plants which are used extensively by different industries in the preparation of Ayurvedic medicines/pharmaceuticals in Sri Lanka and about 25 aromatic plants used in perfumery and cosmetic industries in various countries of the world. It is not feasible to take up the R & D work on different agrotechnological development aspects of such a large number of plants at a time and therefore a phase wise R & D programme is to be undertaken keeping in view the requirement of the plant raw material used in different industries engaged in the preparation of Ayurvedic medicines/ pharmaceuticals. An action oriented plan in view of the above is given below which is being prepared after the critical study of the list of threatened medicinal plants in Sri Lanka (Annexure 7), aromatic plants grown (Annexure 8), the medicinal plants flora of Sri Lanka (Annexure 9) and medicinal plants extensively used in Sri Lanka (Annexure 10).

Identification and selection of plant species:

The following activities are to be undertaken:

Domestication of selected crops (based on national priorities) available as natural habitat in Sri Lanka, their adaptation, evaluation, agrotechnology development and cultivation.

Development of agrotechnology of potential crops for which preliminary work has already been done for technology transfer to all concerned in different agroclimatic zones.

Continuous crop improvement programme including development of high yielding, disease resistant and fast growing varieties through conventional and biotechnological methods on the crops which are already under cultivation.

Introduction of crops/high yielding varieties of new and exotic medicinal and aromatic plant species, their adaptation, evaluation and agrotechnological development, and large scale cultivation.

Development of crop rotations and intercropping systems on medicinal and aromatic plants with plantation and other agricultural crops for increasing land use efficiency.

Utilization of waste lands in general and low lands/salt affected soils in particular through cultivation of suitable medicinal and aromatic crops.

Details are given in Annexure 5.

After having improved the agrotechnologies of some of these crops, the CISIR should set up a transfer of technology cell in the Institute for the benefit of the growers of these crops and the industries involved in preparation of pharmaceuticals and other Ayurvedic preparations. CISIR should further be strengthened in respect of scientific & technical manpower and infrastructure, and should also open its regional centres in different zones for continuing R & D work on the plants/problems of national interest.

For the proper and effective implementation of the proposed action plan, it is necessary that either a very senior level agronomist (qualifications and job description given in Annexure V) should be employed or a consultant in the field of Agronomy should be deputed by UNIDO under split mission of 5-6 months in a year in a phased manner to accomplish the task. The consultant should be in Sri Lanka for two months in the beginning of the programme for introduction of new crops and layout of field trials on the crops on which preliminary work has already been done including planting of field trials and post planting care and monitoring. The consultant should visit Sri Lanka 3-4 times in a year at an interval of 3-4 months for a period of one month each time to record observations, analysis and processing of data and also to assess the progress of crop development. The appointment/deputation of a senior level Agronomist/Consultant in the field of agronomy is very much essential as CISIR is lacking in leadership at senior level who can manage to carry out such type of work in a well organized scientific manner.

In addition to above, CISIR should recruit a minimum of 2 scientists in agronomy, 1 scientist in plant breeding, 1 scientist in botany and pharmacognosy, 1 scientist in plant entomology and 01 scientist in plant pathology. These personnel can be recruited at junior level who will be trained by the consultant/senior agronomist employed for the programme. The job description of junior level scientists is given in Annexure 6. There should preferably be a separate division of agriculture sciences initially with the above mentioned staff at CISIR to work on agrotechnology development.

CISIR should take immediate steps to acquire a small farm land at least of 05 hectares around Colombo for conducting initial field trials on different aspects of agrotechnology development. Necessary farm machinery and implements should also be arranged to take up various farm operations during R & D work.

At present, indiscriminate felling of trees bearing medicinal value and collection of other flora is being continued which can off set the ecological balance and biodiversity of the country. In order to save the environment due to this deforestation, it is utmost necessary to discourage the above practice and also to take up the programme on afforestation by way of cultivating plants of medicinal value.

Efforts should be made to procure germ plasm of those medicinal and aromatic plants which are not available in Sri Lanka but can be grown under the conditions of this country for the propagation and cultivation to meet the need of the industries.

Although some training has been imparted to the counterpart staff at CISIR on methods of R&D pertaining to breeding and cultivation of some medicinal and aromatic plants, it is necessary that the staff working in this field should be given rigorous training to have a wide exposure in the field of cultivation, crop improvement and post harvest technology. UNIDO, Indo-Sri Lanka programme and other international agencies should be contacted to seek their help in this regard.

JOB DESCRIPTION

Study the R&D work in Agronomy of medicinal plants carried out presently at the Ceylon Institute of Scientific and Industrial Research (CISIR) and other Institutions.

Discuss the problems and constraints faced by CISIR with respect to systematic cultivation of medicinal plants and propose remedial action.

Assess the potential for systematic cultivation of medicinal plants and recommend the research needs for the development of high yielding, disease resistant and fast growing varieties.

Advice on methods of micropropagation, clonal improvement and setting up of nurseries.

Train counterpart staff on methods of R&D pertaining to breeding and cultivation of medicinal plants.

Prepare an action oriented plan for the development of systematic cultivation of medicinal plants for use in the phytopharmaceutical industry.

Prepare a priority list of plants that could be industrially exploited including any exotic plants.

Submit a comprehensive report on his findings and recommendations for a goal oriented R&D programme to promote and service the phytopharmaceutical industry in Sri Lanka.

COUNTERPART STAFF

- J Ranatunga - Senior Research Officer, Agro Food Technology Division, CISIR 363 Bauddhaloka, Mawatha, Colombo 7.
- L S R Arambewela - Senior Research Agro Food Technology Division, CISIR, 363 Bauddhaloka, Mawatha, Colombo 7.

ANNEXURE 3

LIST OF PEOPLE MET

Dr. L S R Arambewela Senior Research Officer, Agro Food Technology Division, CISIR, 363 Bauddhaloka, Mawatha, Colombo 7.

Ms. J Ranatunga, Senior Research Officer, Agro Food Technology Division, CISIR, 363 Bauddhaloka Mawatha, Colombo 7.

Dr. R O B Wijesekera, Chairman, CISIR, 363 Bauddhaloka Mawatha, Colombo 7.

Dr. P M Jayatissa, Director, CISIR, 363, Bauddhaloka Mawatha, Colombo 7.

Ms. N T Amarasinghe, Manager, Pilot Plant, Process and Plant Engineering Division, CISIR, 363 Bauddhaloka Mawatha, Colombo 7.

Mr. K R Dayananda, Senior Research Officer, Natural Products Development Group, Agro Food Technology Division, CISIR, 363 Bauddhaloka Mawatha, Colombo 7.

Dr. N D Ediriweera, Head Agro Food Technology Division, CISIR, 363 Bauddhaloka Mawatha, Colombo 7.

Mr. S Jayasinghe, Manager Services, Agro Food Technology Division, CISIR, 363 Bauddhaloka, Mawatha, Colombo 7.

Mr. P N S Wijeratne, Assistant Director, Sri Lanka Export Development Board, Trans Asia Building, 115 Sir Chittampalam A Gardiner Mawatha, P.O. Box 1872, Colombo 2.

Ms. W Jayawardena, Chairman Link Natural Products (Pvt) Ltd., 97A Galle Road, Colombo.

Dr. D Nuguwela, Managing Director Link Natural Products (Pvt) Ltd. 97A Galle Road, Colombo 3.

Mr. S Jayakody, Factory Manager, Link Natural Products (Pvt) Ltd. 97 A Galle Road, Colombo 3.

Dr. P J Wickremasinghe, Deputy Director, Export Agriculture Research Station Ministry of Export Agriculture, Matale.

Prof. H P M Gaunasena, Dean, Faculty of Agriculture, University of Peradeniya.

Mr. R Bahardeen, General Manager, Bio Extracts (Pvt) Ltd., Orugodawatte, 10 Mile Post Avenue, Colombo 3.

Mr. N Karunatilake, Chief Quality Controller, Bio Extracts (Pvt) Ltd. Orugodawatte, 10 Mile Post Avenue, Colombo 3.

Dr. L Senaratne, Acting Assistant Director, Bandarnaike Memorial Ayurvedic Research Institute Navinna, Maharagama.

Mr. P Jayanetti, Senior Scientist, Department of Ayurveda, Bandaranaike Memorial Ayurvedic Research Institute, Navinna, Maharagama.

Mr. C K Samarweera, Managing Director, Conifer Products Processing (Pvt) Ltd. Green Gables, Nugathalawa.

Dr. Gunaratne De Silva, Senior Scientific Officer (Botany), Bandarnaike Memorial Ayurvedic Research Institute, Navinna, Maharagama.

Mr. D A. Perera, Managing Partner, EOAS International, 34/3 Lumbini Avenue Ratmalana.

Dr. L M Wijesundra, Chief Pharmaceutist, Sri Lanka Ayurvedic Herbal Products Company, P.O. Box 20, Navinna, Maharagama.

Prof. P E Soysa, Director General, Natural Resources, Energy and Science Authority of Sri Lanka 47/5 Maitland Place Colombo 7.

LIST OF INSTITUTIONS\ORGANIZATIONS VISITED

Bandaranaike Memorial Ayurvedic Research Institute, Navinna, Maharagama

Bio Extracts (Pvt) Ltd, 10 Mile Post Avenue, Colombo 3

CISIR, 363 Bauddhaloka, Mawatha, Colombo 7.

Export Agriculture, Research Station, Matale

Botanic Garden, University of Peradeniya

NARESA of Sri Lanka, 47/5 Maitland Place, Colombo 7.

Conifer Products Processing (Pvt) Ltd., Green Gables, Nugathalawa.

Link Natural Products (Pvt) Ltd., Malinda, Kapugoda.

Ministry of Indigenous medicines, Herbal and Medicinal Plant Garden, Haldumulla.

Sri Lanka Export Development Board, 115 Sir Chittampalam A Gardner Mawatha, Colombo 2.

Sri Lanka Ayurvedic Herbal Products Company, P.O. Box 20, Navinna, Mahargama, Sri Lanka.

EOAS international, 34/3 Lumbini Avenue, Ratmalana.

**ACTION ORIENTED PLAN FOR THE DEVELOPMENT OF SYSTEMATIC
CULTIVATION OF MEDICINAL & AROMATIC PLANTS.**

A. Crops for domestication from Natural Habitats in suitable agroclimatic zones; their adaptation, evaluation, agrotechnology development and cultivation:

1.	<i>Centella asiatica</i>	Wet zone
2.	<i>Coscinium fenestratum</i>	Intermediate zone
3.	<i>Kaempheria galanga</i>	Wet zone
4.	<i>Woodfordia fruticosa</i>	Dry zone/Intermediate zone
5.	<i>Phyllanthus embelica</i>	Dry zone/Intermediate zone
6.	<i>Alpinia galanga</i>	Wet zone/Intermediate zone
7.	<i>Trianthema decandra</i>	Intermediate zone/Dry zone
8.	<i>Plumbago indica</i>	Intermediate zone/Dry zone

B. Crops for development of agrotechnology, and technology transfer for their cultivation:

1.	<i>Solanum xanthocarpum</i>	Dry zone/Intermediate zone
2.	<i>Piper longum</i>	Wet zone/Intermediate zone
3.	<i>Withania somnifera</i>	Dry zone/Intermediate zone
4.	<i>Munronia pumila</i>	Intermediate zone
5.	<i>Rauvolfia serpentina</i>	Dry zone/Intermediate zone
6.	<i>Cassia angustifolia</i>	Intermediate zone
7.	<i>Hemidesmus indicus</i>	Dry zone/Intermediate zone
8.	<i>Andrographis peniculata</i>	Dry zone/Intermediate zone
9.	<i>Plectranthus zeylanicum</i>	Intermediate zone
10.	<i>Indigofera tinctoria</i>	Wet zone
11.	<i>Ocimum sanctum</i>	Intermediate zone
12.	<i>Vetiveria zizanioides</i>	Wet zone/Dry zone
13.	<i>Coriander sativum</i>	Intermediate zone
14.	<i>Punica granatum</i>	Wet zone/Dry zone
		Intermediate zone

C. Crops under cultivation which require crop improvement:

1.	<i>Citronella nardus</i>
2.	<i>Cinnamomum zeylanicum</i>
3.	<i>Myristica fragrance</i>
4.	<i>Eugenia caryophyllata</i>
5.	<i>Piper nigrum</i>
6.	<i>Eliteria cardamomum</i>

D. Introduction of exotic plants in suitable agroclimatic zones of the country; their adaptation, evaluation, agrotechnology development and cultivation:

1.	<i>Duboisia myoporoides</i>	Intermediate zone
2.	<i>Mentha arvensis</i>	Wet zone
3.	<i>Mentha spicata</i>	Wet zone
4.	Citronella Java	Wet zone
5.	<i>Rosmarinus officinalis</i>	Intermediate zone
6.	<i>Salvia officinalis</i>	Hill country at Candy and Nuwara Eliya
7.	<i>Ocimum basilicum</i>	Intermediate zone
8.	<i>Pelargonium graveolens</i>	Intermediate zone
9.	<i>Pogostemon patchouli</i>	Intermediate zone
10.	<i>Matricaria chamomile</i>	Dry zone/Intermediate zone
11.	<i>Cymbopogon martinii</i> var. <i>motia</i> .	Dry zone/Intermediate zone
12.	<i>Vetiveria zizanoides</i>	Wet zone/Dry zone/ (improved variety)Intermediate zone
13.	<i>Apium graveolens</i>	Intermediate zone
14.	<i>Cymbopogon flexuosus</i>	Wet zone/Dry zone/ (improved varieties) Intermediate zone

A. Qualification and Job requirement of Senior Agronomist (Coordinator)

Qualification & Experience: Ph.D. with minimum 15 years experience in the field of agronomical research with proven dynamic leadership in the management of R & D of Medicinal & Aromatic plants. Experience of working on senior R & D management positions at least for a period of 10 years.

Job Requirement: Providing leadership to the R & D groups in the field of medicinal & aromatic plants.

B. Qualification and Job requirement of Junior Scientists

Qualification & Experience: M.Sc. (Ag.) in relevant field with three years experience in R & D of field crops, or Ph.D. in the relevant field with experience of field experimentation.

Job requirement: Carry out research on agronomical/crop improvement /plant protection aspects of medicinal & aromatic crops.

THE THREATENED MEDICINAL PLANTS OF SRI LANKA

1. *Lycopodium clavatum*
2. *Lycopodium phlegmaria*
3. *Actiniopteris radiata*
4. *Helminthostachys zeylanica*
5. *Ophioglossum pendulum*
6. *Cycas circinalis*
7. *Semecarpus obovata*
8. *Semecarpus parvifolia*
9. *Artabotrys hexapetalus*
10. *Polyalthia persicaefolia*
11. *Xylopia nigricans*
12. *Hunteria zeylanica*
13. *Petchia ceylanica*
14. *Rauvolfia serpentina*
15. *Cryptocoryne spiralis*
16. *Rhaphidophora decursiva*
17. *Hoya pauciflora*
18. *Marsdenia tenacissima*
19. *Oxystelma esculentum*
20. *Balanophora fungosa*
21. *Impatiens repons*
22. *Gynura hispida*
23. *Xanthium indicum*
24. *Kalanchoe laciniata*
25. *Scirpodendron ghaeri*
26. *Vatica obscura*
27. *Dioscorea spicata*
28. *Cotylelobium scabriusculum*
29. *Hopea cordifolia*
30. *Shorea disticha*
31. *Shorea ovalifolia*
32. *Vatica obscura*
33. *Diospyros atrata*
34. *Diospyros attenuata*
35. *Diospyros oppositifolia*
36. *Diospyros quaesita*
37. *Elasocarpus montanus*
38. *Agrostistachys hookeri*
39. *Cleistanthus collinus*
40. *Putranjiva zeylanica*
41. *Calophyllum cuneifolium*
42. *Hippocratea macrantha*
43. *Cinnamomum litseifolium*
44. *Cryptocarya membranacea*
45. *Acacia ferruginea*
46. *Adenantha bicolar*
47. *Albizia amara*
48. *Cassia senna*

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| 49. <i>Caesalpinia crista</i> | 59. <i>Olea paniculata</i> |
| 50. <i>Caesalpinia major</i> | 60. <i>Dendrobium maccarthiae</i> |
| 51. <i>Cynometra iripa</i> | 61. <i>Rhynchosyilis retusa</i> |
| 52. <i>Desmodium gangeticum</i> | 62. <i>Areca concinna</i> |
| 53. <i>Pericopsis mooniana</i> | 63. <i>Nypa frutican</i> |
| 54. <i>Memecylon grande</i> | 64. <i>Tricalysia erythospora</i> |
| 55. <i>Coscinium fenestratum</i> | 65. <i>Palaguium thwaitesii</i> |
| 56. <i>Nymphoides aurantiaca</i> | 66. <i>Pentpetes phoenicea</i> |
| 57. <i>Broussonetia zeylanica</i> | 67. <i>Pterygota thwaitesii</i> |
| 58. <i>Ficus trimenii</i> | |

Source: The threatened plants of Sri Lanka - UNESCO-Man and the biosphere National Committee for Sri Lanka Pub. No. 10. (Received through CISIR)

AROMATIC PLANTS GROWN IN SRILANKA

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| 1. <i>Cinnamomum zeylanicum</i> | 7. <i>Myristica fragrance</i> (Mace) |
| 2. <i>Cymbopogon citratus</i> | 8. <i>Pinus caribaea</i> |
| 3. <i>Cymbopogon nardus</i> | 9. <i>Piper nigrum</i> |
| 4. <i>Elettaria cardamomum</i> | 10. <i>Piper betel</i> |
| 5. <i>Eugenia caryophyllata</i> | 11. <i>Vetiveria zizanioides</i> |
| 6. <i>Myristica fragrance</i> (Nutmeg) | 12. <i>Zingiber officinalis</i> |

Source: CISIR

MEDICINAL PLANTS FLORA OF SRI LANKA

Abies spectabilis *Alocasia macrorrhiza*
Abrus precatorius *Aloe vera*
Abutilon asiaticum *Alstonia scholaris*
Abutilon indicum *Alternanthera sessilis*
Acacia catechu *Alysicarpus vaginalis*
Acacia chundra *Amaranthus paniculatus*
Acacia nilotica *Amaranthus polygonoides*
Acalypha indica *Amaranthus spinosus*
Acanthus ilicifolius *Amaranthus tricolor*
Achyranthes aspera *Amaranthus viridis*
Aconitum ferox *Amomum masticatorium*
Aconitum heterophyllum *Amoora rohituka*
Acorus calamus *Amorphophallus campanulatus*
Acronychia pedunculata *Ampelocissus indica*
Adansonia digitata *Anacardium occidentale*
Adenosma capitatum *Anacyclus pyrethrum*
Adhatoda vasica *Anamirta cocculus*
Adiantum caudatum *Ananas comosus*
Adiantum philippense *Anaphalis subdecurrens*
Adina cordifolia *Andrographis paniculata*
Aegle marmelos *Anisochilus carnosus*
Aerva lanata *Anisomeles indica*
Ageratum conyzoides *Annona squamosa*
Aglaia roxburghiana *Anoectochilus setaceus*
Ailanthus triphysa *Anogeissus latifolia*
Alangium salviifolium *Anthocephalus cadamba*
Albizzia odoratissima *Antiaris toxicaria*
Alhagi camelorum *Apium graveolens*
Allium ascalonicum *Aponogeton crispus*
Allium sativum *Aquilaria agallocha*
Allophylus cobbe *Arachis hypogaea*
Allophylus zeylanicus *Areca catechu*
Alocasia indica *Argemone mexicana*
Argyrea nervosa *Boerhavia diffusa*
Argyrea populifolia *Borassus flabellifer*
Arisaema leschenaultii *Borreria hispida*
Aristolochia bracteolata *Boswellia serrata*
Aristolochia indica *Brachiaria mutica*
Artanema longifolium *Brassica alba*
Artemisia vulgaris *Brassica integrifolia*
Artocarpus heterophyllus *Brassica nigra*
Asclepias curassavica *Bridelia retusa*
Asparagus falcatus *Brucea javanica*
Asparagus racemosus *Bryonopsis laciniosa*
Asteracantha longifolia *Buchanania lanzan*
Atalantia ceylanica *Butea monosperma*

Atalantia missionis
Averrhoa bilimbi *Caesalpinia bonduc*
Averrhoa carambola *Caesalpinia digyna*
Azadirachta indica *Caesalpinia major*
Bacopa monnieri *Caesalpinia sappan*
Balanites aegyptiaca *Calamus rotang*
Bambusa arundinacea *Callicarpa tomentosa*
Barleria prionitis *Calophyllum inophyllum*
Barringtonia acutangula *Calophyllum tomentosum*
Barringtonia ceylanica *Calophyllum walkeri*
Barringtonia racemosa *Calotropis gigantea*
Basella alba *Canarium zeylanicum*
Bauhinia acuminata *Cannabis sativa*
Bauhinia racemosa *Canscora decussata*
Bauhinia tomentosa *Capparis horrida*
Bauhinia variegata *Capparis moonii*
Benincasa hispida *Capparis zeylanica*
Berberis aristata *Caralluma umbellata*
Betula utilis *Cardiospermum microcarpum*
Biophytum reinwardtii *Careya coccinea*
Blepharis repens *Carica papaya*
Blumea mollis *Carissa carandas*
Carmona microphylla *Clerodendrum infortunatum*
Carum carvi *Clerodendrum serratum*
Carum copticum *Clitoria ternatea*
Caryota urens *Coccinea grandis*
Casearia zeylanica *Cocculus hirsutus*
Cassia absus
Cassia alata *Cocos nucifera*
Cassia angustifolia *Coleus amboinicus*
Cassia auriculata *Colocassia esculenta*
Cassia fistula *Colocynthis citrullus*
Cassia obovata *Colocynthis vulgaris*
Cassia occidentalis *Colubrina asiatica*
Cassia sophera *Commelina diffusa*
Cassia tora *Commiphora mukul*
Catharanthus roseus *Corallocarpus epigaeus*
Cayratia pedata *Corchorus capsularis*
Cedrus deodara *Corchorus olitorius*
Ceiba pentandra *Cordia dichotoma*
Celastrus paniculatus *Coriandrum sativum*
Celtis cinnamomea *Corypha umbraculifera*
Centella asiatica *Coscinium fenestratum*
Centipeda minima *Costus speciosus*
Centranthera indica *Crataeva religiosa*
Cicer arietinum *Crinum asiaticum*
Cinnamomum camphora *Crinum bulbispermum*
Cinnamomum zeylanicum *Crocus sativus*
Cissampelos pareira *Crotalaria juncea*
Cissus quadrangularis *Crotalaria verrucosa*
Citrus aurantifolia *Croton lacciferus*
Citrus aurantium *Croton tiglium*

Citrus medica *Cryptocoryne spiralis*
Citrus sinensis *Cryptolepis buchananii*
Clausena indica *Cucumis callosus*
Cleistanthus collinus *Cucumis melo*
Clematis gouriana *Cucumis sativus*
Clerodendrum inerme *Cucurbita maxima*
Echlinochloa crus-galli
Cuminum cyminum *Eclipta prostrata*
Curcuma aromatica *Elaeodendron glaucum*
Curcuma domestica *Elephantopus scaber*
Curcuma zedoaria *Elettaria repens*
Cuscuta chinensis *Eleusine coracana*
Cuscuta reflexa *Eleusine indica*
Cyanotis axillaris *Embelia ribes*
Cycas circinalis *Emilia sonchifolia*
Cyclamen indicum *Entada phaseoloides*
Cyclea burmanni *Ephemerantha macraei*
Cymbopogon citratus *Ervatamia divaricata*
Cymbopogon nardus *Erythrina variegata*
Cymbopogon polyneuros *Erythroxyllum monogynum*
Cynodon dactylon *Erythroxyllum moonii*
Cyperus rotundus *Eugenia bracteata*
Eugenia caryophyllata
Datura metel *Euodia lunu-ankenda*
Datura suaveolens *Eupatorium triplinerve*
Desmodium gangeticum *Euphorbia antiquorum*
Desmodium heterophyllum *Euphorbia hirta*
Desmodium triflorum *Euphorbia indica*
Desmostachya bipinnata *Euphorbia neriifolia*
Dichrostachys cinerea *Euphorbia thymifolia*
Dillenia indica *Euphorbia tirucalli*
Dillenia retusa *Euphorbia longana*
Dimorphocalyx glabellus *Evolvulus alsinoides*
Diospyros malabarica *Exacum trinerve*
Dipterocarpus glandulosus *Excoecaria agallocha*
Dipterocarpus zeylanicus
Dolichos biflorus
Dregia volubilis *Feronia limonia*
Drymoglossum heterophyllum *Ferula asafoetida*
Dysophylla auricularia *Ficus benghalensis*
Ficus hispida *Helecteres isora*
Ficus racemosa *Heliotropium indicum*
Ficus religiosa *Helminthostachys zeylanica*
Flacourtia cataphracta *Hemidesmus indicus*
Flacourtia ramontchi *Heteropogon contortus*
Foeniculum vulgare *Hibiscus abelmoschus*
Hibiscus esculentus
Garcinia cambogia *Hibiscus furcatus*
Garcinia mangostana *Hibiscus rosa-sinensis*
Garcinia morella *Hibiscus tiliaceus*
Garenia latifolia *Holarrhena antidysenterica*
Gaultheria rudis *Holarrhena mitis*

Geophila herbacea Holoptelea integrifolia
 Girardenia zeylanica Hordeum vulgare
 Gironniera cuspidata Horsfieldia irya
 Gisekia pharnacioides Horsfieldia iryagedhi
 Glinus oppositifolius Hoya ovalifolia
 Globba bulbifera Hugonia mystax
 Gloriosa superba Hydnocarpus venenata
 Glycosmis pentaphylla Hydnocarpus wightiana
 Glycyrrhiza glabra Hydrocotyle javanica
 Gmelina arborea Hyoscyamus niger
 Gmelina asiatica Hyserpa nitida
 Gnidia eriocephala
 Gossypium herbaceum Ichnocarpus frutescens
 Grewia polygamalmpatiens repens
 Grewia tiliifolia Imperata cylindrica
 Gymnema sylvestre Indigofera aspathaloides
 Gynandropsis gynandra Indigofera enneaphylla
 Gynocardia odorata Indigofera tinctoria
 Gynura pseudo-chinalpomoea angustifolia
 Gyrinops walla Ipomoea aquatica
 Ipomoea asarifolia
 Hedyotis auricularia Ipomoea mauritiana
 Hedyotis fruticosa Ipomoea maxima
 Hedyotis nitida Ipomoea nil
 Ipomoea obscura Litsea longifolia
 Ipomoea pes-caprae Lobelia nicotianifolia
 Ipomoea pes-tigridis Luffa acutangula
 Ixora coccinea Luffa cylindrica
 Lycopodium cernuum
 Jasminum angustifolium Lycopodium phlegmaria
 Jasminum grandiflorum Lycopodium pulcherrimum
 Jasminum sambac
 Jatropha curcas Macaranga peltata
 Jatropha glandulifera Madhuca fulva
 Jatropha podagrica Madhuca longifolia
 Jussiaea suffruticosa Madhuca neriifolia
 Justicia betonica Magnolia fuscata
 Justicia gendarussa Mallotus philippensis
 Justicia procumbens Mangifera indica
 Manilkara hexandra
 Kaempferia galanga Maranta arundinacea
 Kaempferia rotunda Marsdenia tenacissima
 Kalanchoe laciniata Melaleuca leucadendra
 Kokoona zeylanica Melia azedarach
 Melia dubia
 Lagenaria siceraria Melothria heterophylla
 Lagerstroemia speciosa Melothria maderaspatana
 Languas (Alpinia) calcarata Memecylon capitellatum
 Languas (Alpinia) chinensis Memecylon umbellatum
 Languas (Alpinia) galanga Memordica dioica
 Lannea coromandelica Mentha arvensis
 Lasia spinosa Mentha sylvestris

Lawsonia inermis *Mesua ferrea*
Leea indica *Michelia champaca*
Lens culinaris *Micromelum ceylanicum*
Leonotis nepetaefolia *Mimosa pudica*
Leucas marrubioides *Mimusops elengi*
Leucas zeylanica *Mirabilis jalapa*
Limnophila conferta *Mitragyna parvifolia*
Litsea glutinosa *Mitragyna tubulosa*
Mollugo cerviana *Operculina turpethum*
Mollugo pentaphylla *Ophioglossum pedunculatum*
Momordica charantia *Ophiorrhiza mungos*
Morinda citrifolia *Opuntia dillenii*
Morinda tinctoria *Oroxylum indicum*
Moringa oleifera *Oryza sativa*
Mucuna prurita *Osbeckia octandra*
Munronia pumila *Oxalis corniculata*
Murraya koenigii
Mussaenda frondosa *Paederia foetida*
Myristica dactyloides *Pancreatum zeylanicum*
Myristica fragrans *Pandanus ceylanicus*
Naravelia zeylanica *Pandanus tectorius*
Nardostachys jatamansi *Panicum antidotale*
Nauclea orientalis *Panicum miliare*
Nelumbo nucifera *Papaver rhoeas*
Neolitsea involucrata *Papaver somniferum*
Nerium oleander *Paramignya monophylla*
Nigella sativa *Paspalum scrobiculatum*
Nyctanthes arbor-tristis *Pavetta indica*
Nymphaea lotus *Pavonia odorata*
Nymphaea stellata *Pedaliium murex*
Nypa fruticans *Peganum harmala*
Pentapetes phoenicea
Ochna jabotapita *Pergularia daemia*
Ochna squarrosa *Peucedanum graveolens*
Ocimum americanum *Phaseolus radiatus*
Ocimum basilicum *Phaseolus mungo*
Ocimum gratissimum *Phoenix zeylanica*
Ocimum sanctum *Phyllanthus nodiflora*
Olax zeylanica *Phyllanthus debilis*
Oldenlandia biflora *Phyllanthus emblica*
Oldenlandia corymbosa *Phyllanthus reticulatus*
Oldenlandia herbacea *Phyllanthus urinaria*
Oldenlandia umbellata *Picrorrhiza kurrooa*
Pimpinella anisum *Quercus lusitanica*
Piper betle
Piper chavya *Randia dumetorum*
Piper cubeba *Rauvolfia serpentina*
Piper longum *Rejoua dichotoma*
Piper nigrum *Rhamnus wightii*
Pisonia grandis *Rhaphidophora laciniata*
Pistacia integerrima *Rhinacanthus nasuta*
Pistia stratiotes *Rhododendron zeylanicum*

Plantago erosa Rhus succadanea
 Plectranthus zeylanicus Ricinus communis
 Plumbago indica Rubia cordifolia
 Plumbago zeylanica Rungia repens
 Plumeria acuminata Ruta graveolens
 Pogostemon heyneanus
 Pogostemon parviflorus Saccharum arundinaceum
 Polygonum barbatum Saccharum officinarum
 Polygonum chinense Salacia prinoides
 Polygonum pulchrum Salacia reticulata
 Pongamia pinnata Salmalia malabarica
 Portulaca oleracea Salvadora persica
 Portulaca quadrifida Samadera indica
 Pothos scandens Sansevieria zeylanica
 Premna herbacea Santalum album
 Premna latifolia Sapindus emarginatus
 Premna serratifolia Sapindus trifoliatus
 Premna tomentosa Sapium indicum
 Prunus cerasoides Saraca indica
 Psidium guajava Sarcostemma brunonianum
 Psoralea corylifolia Saussurea lappa
 Pterocarpus marsupium Schleicheria oleosa
 Pterocarpus santalinus Scindapsus officinalis
 Pterospermum canescens Securinega leucopyrus
 Punica granatum Selaginella wightii
 Putranjiva roxburghii Semecarpus anacardium
 Semecarpus coriacea Strychnos potatorum
 Semecarpus gardneri Swertia chirayita
 Semecarpus obovata Symplocos loha
 Semecarpus obscura Symplocos racemosa
 Semecarpus subpeltata Syzygium caryophyllatum
 Sesamum indicum Syzygium cumini
 Sesbania grandiflora Syzygium zeylanicum
 Sesbania sesban
 Setaria italica Tamarindus indica
 Shorea robusta Tarenna asiatica
 Sida acuta Tectona grandis
 Sida alba Tephrosia purpurea
 Sida cordifolia Tephrosia villosa
 Sida racemosa Terminalia arjuna
 Sida rhombifolia Terminalia bellirica
 Sida veronicaefolia Terminalia catappa
 Smilax zeylanica Terminalia chebula
 Smithia conferta Terminalia tomentosa
 Solanum ferox Thespesia populnea
 Solanum indicum Tiliacora acuminata
 Solanum nigrum Tinospora cordifolia
 Solanum surattense Tinospora glabra
 Solanum trilobatum Tinospora malabarica
 Solanum verbascifolium Toddalia asiatica
 Solanum xanthocarpum Torenia travancorica
 Soyimida febrifuga Trachyspermum roxburghianum

Sphaeranthus indicus Tragia involucrata
 Spilanthes paniculata Trianthena decandra
 Spondias pinnata Trianthena portulacastrum
 Stephania japonica Tribulus terrestris
 Sterculia balanghas Trichosanthes anguina
 Sterculia urens Trichosanthes bracteata
 Stereospermum suaveolens Trichosanthes cucumerina
 Streblus asper Trigonella corniculata
 Strychnos nux-vomica
 Trigonella foenum-graecum Walsura piscidia
 Tylophora indica Wedelia chinensis
 Tylophora flava Wendlandia bicuspidata
 Typhonium trilobatum Wissadula periplocifolia
 Withania somnifera
 Uraria picta Woodfordia fruticosa
 Wrightia antidysenterica
 Valeriana wallichii Wrightia tomentosa
 Vanda tessellata
 Ventilago maderaspatana Xanthium strumarium
 Vernonia anthelmintica Xyris indica
 Vernonia cinerea
 Vernonia zeylanica Zanonina indica
 Vetiveria zizanioides Zanthoxylum tetraspermum
 Vigna marina Zeuxine regia
 Vitex leucoxydon Zingiber officinale
 Vitex negundo Zizyphus jujuba
 Vitex peduncularis Zizyphus mauritiana
 Vitex trifolia Zizyphus napeca
 Vitis vinifera Zizyphus oenoplia
 Zizyphus rugosa

**MAJOR MEDICINAL PLANTS USED IN AYURVEDIC
PREPARATIONS/PHARMACEUTICALS IN SRILANKA**

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| 1. <i>Acacia catechu</i> | 31. <i>Canarium zeylanicum</i> |
| 2. <i>Achyranthes aspera</i> | 32. <i>Capparis horrida</i> |
| 3. <i>Acorus calamus</i> | 33. <i>Carissa carandas</i> |
| 4. <i>Acronychia pedunculata</i> | 34. <i>Cassia angustifolia</i> |
| 5. <i>Adhatoda vasica</i> | 35. <i>Cassia fistula</i> |
| 6. <i>Aegle marmelos</i> | 36. <i>Cassia occidentalis</i> |
| 7. <i>Aerva lanata</i> | 37. <i>Cassia tora</i> |
| 8. <i>Alahagi camelomum</i> | 38. <i>Catharanthus roseus</i> |
| 9. <i>Aloe vera</i> | 39. <i>Celastrus paniculatus</i> |
| 10. <i>Alpinia galanga</i> | 40. <i>Centella asiatica</i> |
| 11. <i>Alstonia scholaris</i> | 41. <i>Citrus aurantium</i> |
| 12. <i>Amorphophallus campanulatus</i> | 42. <i>Cleome viscosa</i> |
| 13. <i>Andrographis paniculata</i> | 43. <i>Clerodendrum infortunatum</i> |
| 14. <i>Anethum graveolens</i> | 44. <i>Clerodendrum serratum</i> |
| 15. <i>Apium graveolens</i> | 45. <i>Clitoria ternatea</i> |
| 16. <i>Aristolochia indica</i> | 46. <i>Colocynthis vulgaris</i> |
| 17. <i>Asparagus racemosus</i> | 47. <i>Coriandrum sativum</i> |
| 18. <i>Azadirachta indica</i> | 48. <i>Costus speciosus</i> |
| 19. <i>Barleria prionitis</i> | 49. <i>Coscinium fenestratum</i> |
| 20. <i>Barringtonia racemosa</i> | 50. <i>Crateva religiosa</i> |
| 21. <i>Bauhinia racemosa</i> | 51. <i>Crinum asiaticum</i> |
| 22. <i>Bauhinia tomentosa</i> | 52. <i>Croton tiglium</i> |
| 23. <i>Berberis aristata</i> | 53. <i>Cuminum cyminum</i> |
| 24. <i>Boerhavia diffusa</i> | 54. <i>Cuuruligo orchioides</i> |
| 25. <i>Buchnanania angustifolia</i> | 55. <i>Curcuma aromatica</i> |
| 26. <i>Butea monosperma</i> | 56. <i>Curcuma domestica</i> |
| 27. <i>Ceasalpinia bonduc</i> | 57. <i>Curouma zedoaria</i> |
| 28. <i>Ceasalpinia sappan</i> | 58. <i>Cyperus rotundus</i> |
| 29. <i>Callicarpa tomentosa</i> | 59. <i>Datura metel</i> |

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| 30. | <i>Calotropis gigantea</i> | 60. | <i>Desmodium gangeticum</i> |
| 61. | <i>Dillenia indica</i> | 96. | <i>Leucas zeylanica</i> |
| 62. | <i>Diospyros malbarica</i> | 97. | <i>Lobelia nicotianifolia</i> |
| 63. | <i>Dolichos biflorus</i> | 98. | <i>Mallotus philippensis</i> |
| 64. | <i>Eclipta prostrata</i> | 99. | <i>Marsdenia tenacissima</i> |
| 65. | <i>Embelia ribes</i> | 100. | <i>Mimosa pudica</i> |
| 66. | <i>Entada phaseoloides</i> | 101. | <i>Mimusops elengi</i> |
| 67. | <i>Erythrina variegata</i> | 102. | <i>Mirabilis jalapa</i> |
| 68. | <i>Erythroxyllum moonii</i> | 103. | <i>Momordica charantia</i> |
| 69. | <i>Euphorbia thymifolia</i> | 104. | <i>Moringa oleifera</i> |
| 70. | <i>Euphorbia tirucalli</i> | 105. | <i>Munronia pumila</i> |
| 71. | <i>Euphorbia hirta</i> | 106. | <i>Murraya koenigii</i> |
| 72. | <i>Feronia limonia</i> | 107. | <i>Mucuna puriens</i> |
| 73. | <i>Ficus caloosa</i> | 108. | <i>Nothopegia beddomei</i> |
| 74. | <i>Ficus hispida</i> | 109. | <i>Nigella sativa</i> |
| 75. | <i>Ficus racemosa</i> | 110. | <i>Nyctanthes arbor-tristis</i> |
| 76. | <i>Garcinia cambogia</i> | 111. | <i>Ocimum sanctum</i> |
| 77. | <i>Gardinia latifolia</i> | 112. | <i>Operculina turpethum</i> |
| 78. | <i>Gardinia morella</i> | 113. | <i>Oroxylum indicum</i> |
| 79. | <i>Gloriosa superba</i> | 114. | <i>Oxalis corniculata</i> |
| 80. | <i>Gmelina arborea</i> | 115. | <i>Paederia foetida</i> |
| 81. | <i>Glycosmis pentaphylla</i> | 116. | <i>Pavonia odorata</i> |
| 82. | <i>Gymnema sylvestre</i> | 117. | <i>Pedaliium murex</i> |
| 83. | <i>Hemidesmus indicus</i> | 118. | <i>Phyllanthus emblica</i> |
| 84. | <i>Hibiscus abelmoschus</i> | 119. | <i>Piper chaba</i> |
| 85. | <i>Hibiscus sabdariffa</i> | 120. | <i>Piper longum</i> |
| 86. | <i>Holarrhena antidysenterica</i> | 121. | <i>Piper sylvestre</i> |
| 87. | <i>Hydnocarpus venenta</i> | 122. | <i>Plectranthus zeylanica</i> |
| 88. | <i>Indigofera tinctoria</i> | 123. | <i>Plumbago indica</i> |
| 89. | <i>Ipomea mauritiana</i> | 124. | <i>Plumbago zeylanica</i> |
| 90. | <i>Ixora coccinea</i> | 125. | <i>Pongamia pinnata</i> |
| 91. | <i>Jatropha glandulifera</i> | 126. | <i>Premna serratifolia</i> |
| 92. | <i>Kaempferia galanga</i> | 127. | <i>Psoralea corylifolia</i> |
| 93. | <i>Kalanchoe laciniata</i> | 128. | <i>Pterocarpus marsupium</i> |
| 94. | <i>Lawsonia inermis</i> | 129. | <i>Punica granatum</i> |
| 95. | <i>Leonotis nepetifolia</i> | 130. | <i>Randia dumetorum</i> |
| 131. | <i>Rauwolfia serpentina</i> | 151. | <i>Strychnos potatorum</i> |

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| 132. | <i>Rubia cordifolia</i> | 152. | <i>Symplocos racemosa</i> |
| 133. | <i>Ruta graveolens</i> | 153. | <i>Terminalia arjuna</i> |
| 134. | <i>Salamalia malabarica</i> | 154. | <i>Terminalia belerica</i> |
| 135. | <i>Samadara indica</i> | 155. | <i>Terminalia chebula</i> |
| 136. | <i>Santalum album</i> | 156. | <i>Thespesia populnea</i> |
| 137. | <i>Saraca asoca</i> | 157. | <i>Tinospora cordifolia</i> |
| 138. | <i>Scindapsis officinalis</i> | 158. | <i>Trachyspermum roxburghianum</i> |
| 139. | <i>Semicarpus anacardium</i> | 159. | <i>Tribulus terrestris</i> |
| 140. | <i>Sesbania grandiflora</i> | 160. | <i>Trichosanthes cucumerina</i> |
| 141. | <i>Sida cordifolia</i> | 161. | <i>Trigonella foenum-gracum</i> |
| 142. | <i>Smilax china</i> | 162. | <i>Tylophora indica</i> |
| 143. | <i>Solanum xanthocarpus</i> | 163. | <i>Uraria picta</i> |
| 144. | <i>Solanum indicum</i> | 164. | <i>Vernonia cinerea</i> |
| 145. | <i>Solanum nigrum</i> | 165. | <i>Vetiveria zizanioides</i> |
| 146. | <i>Solanum trilobatum</i> | 166. | <i>Vitex negundo</i> |
| 147. | <i>Sphaeranthus indicus</i> | 167. | <i>Withania somnifera</i> |
| 148. | <i>Spilanthes paniculata</i> | 168. | <i>Woodfordia fruticosa</i> |
| 149. | <i>Stereospermum personatum</i> | 169. | <i>Zingiber officinale</i> |
| 150. | <i>Strychnos nux-vomica</i> | 170. | <i>Zizyphus mauritiana</i> |