INFORMATION

CONSERVING TRAIT SPECIFIC GERMPLASM OF MEDICINAL PLANTS– CATERING TO NEEDS OF PHARMACEUTICAL INDUSTRIES

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Abstract: Medicinal plants sector continues to be the multi-billion dollar market globally. Since transgenic medicinal plants are not accepted in the herbal sector, classical breeding approaches are the only option for the crop improvement programmes. India having about eight per cent of world's biodiversity including the medicinal plant genetic resources, has the potential of becoming a major global player in market for medicinal plants based herbal formulations, medicines and products. As the demand for herbal medicines is growing in developing countries and consumers in developed countries are averted with modern medications are seeking alternatives medicines. It has also revived the interest by the multinational pharmaceutical industry in bio-prospecting (Singh, 2006).

Keywords: Cultivation, Herbal medicine, Medicinal plants

INTRODUCTION

Dealing with breeding objectives of increased yield of valuable compounds, elimination of unwanted compounds, tolerance to biotic and abiotic stresses and better homogeneity of the genotypes. India being, a diversity rich country and home of ayurvedicsciences, possess high natural variability at generic as well as species level of these medicinal plants. This immense variability not only favours the traditional breeding methods which are easy to handle with low inputs but also allow handsome returns on investment with even low seed sales quantity.

At the beginning of any breeding program, a breeder should get all information about the natural diversity of the targeted traitsas availability of appropriate genetic resources is a key for timely and effective improvementprogramme. Medicinal plants have significant economic and social benefits, and considering the number of species of medicinal plants, the amount of breeding work conducted till date is not sufficient mainly because the characterization of a large number of species is still under cover.

A large of institution under the umbrella of CSIR, ICAR, SAU's and ministries like AYUSH, Health and Family Welfare, Environment and Climate Change are working on the research programme on developing superior high yielding varieties of medicinal plants to ensure quality drug formulations and export of good quality raw material to Global market. It is estimated that about 960 plant species are used by Indian Herbal Industry, and the turn over is more than Rs 80 billion (Sahoo and Manchikanti, 2013). Today, Indian share in Global Herbal market is less than 1% mainly because of non-availability of good quality high yielding varieties with industry-desired traits for commercial cultivation. Hence the availability of trait-specific genotypes will serve a ready to use initial breeding material tothevarious crop improvementprogrammes being undertaken by Research and Development units at different institutions. NBPGR under the aegis of ICAR is serving to this noble cause by registering the valued trait specific germplasm of all agri-horticultural crops, which includes medicinal plants, and conserving these for future use at National Genebank. The system known as "Plant Germplasm Registration" works under the Chairmanship of DDG (Crop Science) Indian Council of Agriculture Research and Head, Division of Germplasm Conservation as Member Secretary, is in place since 1996. Till date forty meetings have been conducted and a total of 1526 accessions of various crops have been registered for various yield,biotic and abiotic stress tolerant characters (table 1). Of these total, 91accession belonging to 49 speciesare of medicinal and spices genera. The medicinal species accessions are 59 *i.e.*3.86 % of the total registered germplasm (Fig. 1) but the species representation among total germplasm registered, it is around 21.77 % of the total number of species of registered germplasm (out of 225 species 49 belongs to medicinal category). Table 2enumerate the various species wise accession registered for various agro-morphological, abiotic and biotic stresses and quality traits which can exploited by breeders in future breeding programmes(Kak and Gupta, 2017).

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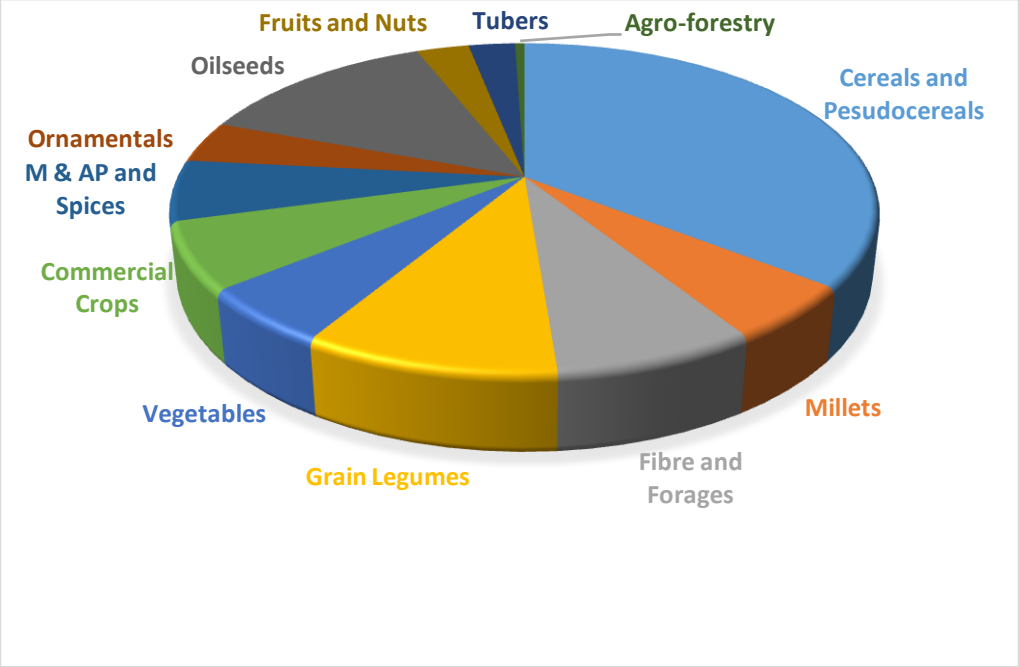

Fig. 1.Accession wise crop groups representation of registered germplasm

Table 1. Conservation status of registered germplasm at National Genebank

Crop group	**Total accessions**	**No. of species**
Cereals and Pesudocereals	543	10
Millets	82	5
Fibre and Forages	119	16
Grain Legumes	151	16
Vegetables	84	22
Commercial Crops	100	16
M & AP and Spices	91	49
Ornamentals	62	28
Oilseeds	203	22
Fruits and Nuts	44	21
Tubers	39	13
Agro-forestry	8	7
Grand Total	**1526**	**225**

Table 2.

S. No	Crop Name	Botanical Name	National Identity	Pedigree	Developing Institute	Novel_Unique_Features
1	Sweet Basil	*Ocimumbasilicum*	EC174527	Germplasm	ICAR-National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi	Essential Oil rich in Linalool content (~ 61.18 ± 4.41%) in oil isolated from aerial plant parts.
2	Holy Basil	*Ocimum sanctum*	IC0627270	Selection DOS-1 having maximum number of PGs (0.5 mm2) leaf area, dry leaf recovery and essential oil contents was identified in the year 2015. It was collected from Mogar, Anand.	ICAR-Directorate of Medicinal and Aromatic Plants Research, Anand, Gujarat	Number of PGs in leaf. Dry leaf recovery (23.10 %),. Essential oil contents (0.65 %) in green herbage and leaves.
3	Holy Basil	*Ocimum sanctum*	IC0627271	Rudra-2 is a dwarf and early flowering type selection identified in year 2015. It was collected from Rudraprayag, Uttarakhand and maintained at the Directorate of Medicinal and Aromatic Plants Research (DMAPR), Anand.	ICAR-Directorate of Medicinal and Aromatic Plants Research, Anand, Gujarat	Dwarf. Early to flower (27.75 days after transplanting).
4	Holy Basil	*Ocimum sanctum*	IC0627272	DOB-1 is a selection having upper leaf (adaxial surface) puckering, light green leaf colour and maximum number of PGs in mature leaf was identified in the year 2015. It was collected from Gangwa, Hissar, Haryana and maintained at the Directorate of Medicinal and Aromatic Plants Research (DMAPR), Anand.	ICAR-Directorate of Medicinal and Aromatic Plants Research, Anand, Gujarat	Upper leaf (adaxial surface) puckering. Light green leaf colour. Maximum number of PGs in mature leaf.
5	Sweet Basil	*Ocimumbasilicum*	EC338785	Germplasm	ICAR-National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi	High Methyl chavicol content (> 88.81±2.34 %) in essential oil isolated from aerial parts.
6	Aloe	*Aloe barbadensis*	IC283959	Clonal progenies of IC283932	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Superior gel (2191.18 g/plant)
7	Aloe	*Aloe barbadensis*	IC283932	Clonal progenies of NMRM 2	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Superior aloin-A (26.13%)
8	Aloe	*Aloe bardadensis*	IC0283932	Seedling progeny selection	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Yellow flowered plant type.
9	Aromatic Galangal	*Kaempferiagalanga*	IC0624537	K-1-6-8	Medicinal Aromatic and Economic Plants Division, CSIR-North East Institute of Science and Technology (NEIST), Jorhat, Assam	High rhizome yields 10 tones/ha. Dry rhizome recovery. High essential oil.
10	Aromatic Galangal	*Kaempferiagalanga*	IC0625983	RRLMK 37	CSIR-North East Institute of Science and Technology, Jorhat, Assam	Higher essential oil yield 2.31 %. Higher rhizome yield 6.75 tones/ha/year. Higher dry rhozome recovery 27.50 %.
11	Greater Galangal	*Alpiniacalcarata*	IC210421	Germplasm collection	ICAR-National Bureau of Plant Genetic Resources (NBPGR), Pusa Campus, New Delhi	High 1,8-cineole content (37.21%) and alpha fenchylacetae (19.87%) content in rhizome/essential oil
12	Greater Galangal	*Alpiniagalanga*	IC349746	Germplasm	ICAR-National Bureau of Plant Genetic Resources (NBPGR), Pusa Campus, New Delhi	High 1,8-Cineole content (72.49%) in rhizome essential oil
13	Kalmegh	*Andrographispaniculata*	IC548348	Selection from KL 2	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Compact plant type with higher andrographoloide content (4.05% in leaf)
14	Kalmegh	*Andrographispaniculata*	IC0593956	Selection from TN 1	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Narrow leaf germplasm with very good andrographoloide (2.97%).
15	Bramhi	*Centellaasiatica*	IC561247	NA	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Morphotype with high leaf area & high asiaticoside (1.62%) content
16	Guggal	*Comiphorawrightii*	IC0593954	Selection	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Male plant of divergent/erect branch type.

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17	Guggal	*Comiphorawrightii*	IC0593955	Selection	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Weeping branch type female plant.
18	Neem	*Azadirachtaindica*	IC296921	CRIDA-8	ICAR-Central Research Insititute for Dryland Agriculture (CRIDA), Vanasthalipuram, Hyderabad, Telangana	High Kernel to seed ratio and high azadirachtin content in seed (0.75%)
19	Neem	*Azadirachtaindica*	IC395308	Local germplasm	ICAR-Indian Institute of Oilseeds Research (IIOR), Hyderabad, Telengana	Bold seeds (30g /100 seeds, 2cm length) high oil content (29.2%) and azadiraction -A content (0.5%)
20	Safed Musli	*Chlorophytumborivilianum*	IC323368	IC 250354	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Fleshy short roots, with blunt end, light diverged type with excellent storage quality
21	Safed Musli	*Chlorophytumborivilianum*	IC323367	IC250354	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Fleshy long roots, with blunt end, dark colour and compact bunch type, with excellent storage quality
22	Senna	*Cassia angustifolia*	IC0610825	DCA-121 is a small size pod bearing selection identified in the year 2010.It was selected from the open pollinated bulk seed of cultivar ALFT-02 maintained at the (DMAPR), Anand.	ICAR-Directorate of Medicinal and Aromatic Research (DMAPR), Anand, Gujarat	Small size pod.
23	Senna	*Cassia angustifolia*	IC0610826	N/A	ICAR-Directorate of Medicinal and Aromatic Research (DMAPR), Anand, Gujarat	Broad leaves. Broad pod shape.
24	Java citronella	*Cymbopogonwinterianus*	IC0619027	C-2-SK-10	CSIR-NORTH East Institute of Science and Technology, Jorhat, Assam	High herbage yield with high essential oil content.
25	Lemon grass	*Cymbopogonflexuosus*	IC0619026	L-39-K-S-9	CSIR-NORTH East Institute of Science and Technology, Jorhat, Assam	High herbage yield with high essential oil content.
26	Malabar Lemon grass	*Cymbopogon khasianus*	IC0625982	MI 657	CSIR-North East Institute of Science and Technology, Jorhat, Assam	High essential oil 0.80 %. Methyle eugenol rich> 75%. High hebage yield 242.5 qtl/ha/year.
27	Malabar Lemon grass	*Cymbopogon khasianus*	IC0625984	MI 530	CSIR-North East Institute of Science and Technology, Jorhat, Assam	High Elemicin content 70 %. High Herbage yield 24.26 tones/ha/year.
28	Lemon grass	*Cymbopogonflexuosus*	IC0625985	MI-43-K-10-74	CSIR-North East Institute of Science and Technology, Jorhat, Assam	High essential oil 1.25 %. High herbage yield 28.32 tones/ha/year. Citral content 76 %.
29	Indian wintergreen/Gultharia	*Gaultheria fragrantissima*	IC0569193	Collection from Darjeeling	Uttar Banga KrishiVishwavidyalaya (UBKV), Cooch Behar, West Bengal	High content of essential oil 1.79%
30	Madhunashini	*Gymnemasylvestre*	IC590890	N/A	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	High fruit producing Madhunashini.
31	Spiked zinger Lily	*Hedychium spicatum*	IC0573223	Wild	ICAR-National Bureau of Plant Genetic Resources (NBPGR), Regional Station, Bhowali, Nainital,Uttarakhand	Bold seeded, early emergence and late senescence.
32	St.JohnWort (Basantphool)	*Hypericumperforatum*	IC0582481	NA	Dr.Yashwant Singh Parmar University of Horticulture and Forestry (YSPUH&F), Nauni, Solan, Himachal Pradesh	Erect-oblong leaf, lamina length: breadth ratio 2:25 approximately
33	St.JohnWort (Basantphool)	*Hypericumperforatum*	IC0582482	NA	Dr.Yashwant Singh Parmar University of Horticulture and Forestry (YSPUH&F), Nauni, Solan, Himachal Pradesh	Prostrate (decumbent) obovate leaf, lamina length: breadth ratio 1:8 approximately
34	St.JohnWort (Basantphool)	*Hypericumperforatum*	IC0582480	NA	Dr.Yashwant Singh Parmar University of Horticulture and Forestry (YSPUH&F), Nauni, Solan, Himachal Pradesh	Semi-erect, oblong lanceolate leaf, lamina length: breadth ratio 3:0 or above
35	Velvet Bean/Kaunch	*Mucunapruriens*	IC599290	Germplasm	ICAR-National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi	High L Dopa content in seeds (7.1% DWB).
36	French lavender/ Camphor lavender	*Lavandulastoechas*	IC0449512	Cultivar.	ICAR-National Bureau of Plant Genetic Resources (NBPGR), Pusa Campus, New Delhi	High Camphor content (52.12%) in essential oil

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37	Malaxis	*Malaxisacuminata*	IC0626004	Selection from hilly Population.	Dr. Y. S. Parmar University of Horticulture and Forestry Solan, Himachal Pradesh	Yellow coloured flowers without any purple tinge. Yellowish green floral buds. Greenish basal sheath at the base of shoot.
38	Mucuna	*Mucunautilis*	IC296847	Germplasm	ICAR-Indian Institute of Horticultural Research, Hassaraghatta Lake Post, Bengaluru, Karnataka	High L-DOPA (9.5%) content in seeds
39	Mucuna	*Mucunautilis*	IC296846	Germplasm	ICAR-Indian Institute of Horticultural Research, Hassaraghatta Lake Post, Bengaluru, Karnataka	High L-DOPA (5.5%) content in seeds
40	Noni	*Morindacitrifolia*	IC524021	Collection from South Andaman	ICAR-Central Agricultural Research Institute (CARI), Port Blair, Andaman and Nicobar Islands	Endemic species, salinity resistant & nutrient rich
41	Velvet bean/Kaunch	*Mucunapruriens*	IC385843	NA	ICAR-National Bureau of Plant Genetic Resources (NBPGR), Pusa Campus, New Delhi	High L-DOPA content (6.30%)
42	Rose-scented geranium	*Pelargonium graveolens*	IC0624503	Soma clonal selection 2013	CSIR-Indian Institute of Integrative Medicine (IIIM), Jammu, Jammu and Kashmir	Higher fresh foliage. High oil content (0.14-0.18%). High rhodinal content (66-75%).
43	Babchi	*Psoraleacorylifolia*	IC111251	NA	ICAR-National Bureau of Plant Genetic Resources (NBPGR), Pusa Campus, New Delhi	High psoralin content
44	Isabgol	*Plantago ovata*	IC561246	NA	Anand Agricultural University (AAU), Anand, Gujarat	Heterostyled stigma protruding out
45	Isabgol	*Plantago ovata*	C0586947	The early maturing mutant of Gl-2 which was identified in M2 generation (0.4% diethyl sulphonate (DES) treatment)	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Early maturing (80-85 days), high harvest index (>22%)
46	Isabgol	*Plantago ovata*	IC0598208	GI-2	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	Golden yellow leaf colour mutant.
47	Isabgol	*Plantago ovata*	IC0623443	The DPO 9 is mutant of isabgol cultivar Gl-2.	ICAR-Directorate of Medicinal and Aromatic Research (DMAPR), Anand, Gujarat	Extended bract mutant.
48	Nepalese kutki	*Picrorhizascrophularii flora*	IC0569192	Collection from Kuppup/Sikkim	Uttar Banga KrishiVishwavidyalaya (UBKV), Cooch Behar, West Bengal	High content of picroside (7.33%dw)
49	Opium poppy	*Papaver somniferum*	IC0625991	Breeding method PAPAVER SOMNIFERUM L.(NBRI-1) X PAPAVER SETIGERUM	CSIR-National Botanical Research Institute, Lucknow, Uttar Pradesh	Rich in Thebaine content >10%.
50	Patchouli	*Pogostemoncablin*	IC0625986	JRP-1	CSIR-North East Institute of Science and Technology, Jorhat, Assam	High essential oil yield. High herbage yield 3220 kg /year.
51	Poppy	*Papaver somniferum*	IC296824	Mass-2B(var. sampada), CI-Comb-113-2	CSIR-Central Institute for Medicinal and Aromatic plants (CIMAP), Lucknow, Uttar Pradesh	Opiumless, alkaloid-free (non-narcotic) poppy
52	Ashwagandha	*Withaniasomnifera*	IC0588697	A dwarf single plant selection were made from ashwagandha variety, JA 134 (open populated population) during 2007 and was advanced through plant-to-row progeny by selfing each time	Directorate of Medicinal & Aromatic Plant Research (DMAPR), Boriavi, Anand, Gujarat	Dwarf plant type
53	Ashwagandha	*Withaniasomnifera*	IC0590838	Single plant Selection from the plant-to-row progeny of JA 134 population (First selection was made in 2007).	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	A new plant type is a unique and distinct than normal erect type and is useful in future breeding programs.
54	Ashwagandha	*Withaniasomnifera*	IC0623444	Pure line single plant selection of JA 134 variety through repeated selfing	ICAR-Directorate of Medicinal and Aromatic Research (DMAPR), Anand, Gujarat	Revolute rolled leaves.

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55	Ashwagandha	*Withaniasomnifera*	IC0623445	Pure line single plant selection of JA 134 variety through repeated selfing	ICAR-Directorate of Medicinal and Aromatic Research (DMAPR), Anand, Gujarat	Yellow young leaves
56	Giloe	*Tinosporacordifolia*	IC283959	Clonal progenies of IC283959	ICAR-Directorate of Medicinal & Aromatic Plants Research (DMAPR), Anand, Gujarat	High starch (13.32%)
57	Indian Valerian/ Mushkbala	*Valerianajatamansi*	IC0584665	Collection	Department of Forest Products, Dr Y S Parmar University of Horticulture and Forestry, Nauni-Solan, Himachal Pradesh	High valeportriates content (approx. 4%)
58	Stevia	*Stevia rebaudiana*	IC0624505	CSIR-IHBT-ST-2009-2 X CSIR-IHBT-ST-2009-4	CSIR-Institute of Himalayan Bioresource Technology (IHBT), Palampur, Himachal Pradesh	Reb-A/Stevioside ratio =1.25; Rebaudioside-A content (%)=7.34; Stevioside content (%)=5.87;
59	Stevia	*Stevia rebaudiana*	IC0624506	Solid mutant from gamma irradiated seed population	CSIR-Institute of Himalayan Bioresource Technology (IHBT), Palampur, Himachal Pradesh	Delayed flowering by 120 days. Prolonged vegetative phase. More number of harvests per year.

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