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SPECIES DIVERSITY OF *EX-SITU* CONSERVATION OF MEDICINAL AND AROMATIC PLANTS (MAPs) OF HERBAL GARDEN IN I.G.K.V. CAMPUS, RAIPUR, CHHATTISGARH, INDIA

Jiwan Lal[1,*], Jaimangal Tirkey[1], Mexudhan[1], Digvesh Kumar Patel[2], Dayanand Sai Painkra[1], Pratap Toppo[1] and Lalji Singh[1]

[1]Department of Forestry, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.), India.

[2]Department of Environmental Science, Indira Gandhi National Tribal University, Amarkantak (M.P.), India.

*Corresponding author E-mail : ziwan000@gmail.com

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ABSTRACT

The herbal garden was situated at the Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India. The results revealed that thirty-seven species represented by ninteen families in tree species, fifteen species represented by twelve families in shrubs, forty-seven species represented by twenty four families in herb species, six species represented by one family in grasses and ten species represented by nine families in climbers were found in herbal garden. The most abundant families of tree species were Fabaceae are represented with eleven species followed by Malvaceae (representing four species) and Apocynaceae (representing three species), The most abundant families of shrub species were Lamiaceae, Apocynaceae and Acanthaceae each are representing two species, in case of herb species most abundant families are Zingiberaceae (representing nine species) followed by Lamiaceae (representing six species), Asteraceae (representing five species) and Apiaceae (representing three species). Poaceae is the most abundant families of grasses. In case of climbers Piperaceae is abundant family. Medicinal and Aromatic Plants (MAPs) are important for human health and treatment of various types of diseases. The non-sustainable method was used in harvesting of medicinal plants in natural forest is very dangerous to loss of diversity of MAPs. However, reduction in the population of wild and threatened species of MAPs due to over-harvesting and habitat loss in natural forest. The *ex-situ* conservation, cultivation practices and sustainable method is very important for conservation and development of medicinal and aromatic plants.

Key words : Medicinal plant, Aromatic plant, Herbal Garden, Diversity, *Ex-situ* conservation.

Introduction

The potential of medicinal and aromatic plants (MAPs) to supply modern treatments as well as serve as a source of precursor chemicals for the synthesis and manufacture of novel pharmaceuticals has given the MAPs industry a large boost globally (Shahidullah and Emdad, 2010). Approximately, 121 medicinal products that are currently on the market that are clinically beneficial were derived from 90 plant species; of these, 74% were utilized based on traditional beliefs. The value of the global market for medications derived from plants was $1.2 billion in the 1990s, but by 2015, it had increased to $25.6 billion (Roosta *et al*., 2017). This is expected to reach $35.4 billion in 2020 with a compound annual growth rate of 6.6% from 2015 to 2020 (BCC, 2015). Yet another estimate suggests that with the present annual growth of 15–25% for herbal products by 2050, the trade in MAPs will reach US$ 5 trillion (Booker *et al*., 2012). The World Health Organization estimates that 70–95% population in developing countries depends on MAPs for their primary healthcare (WHO, 2011).

In many developing nations, MAPs have been in use for decades and provide access to inexpensive healthcare as well as a source of money(Dangwal and Sharma, 2011;

Baydoun *et al*., 2015). There is evidence that emerging nations account for the majority of the medical plant material sold worldwide (Roosta *et al*., 2017). As a result, MAPs-based industry appears to be a promising field that, when properly managed, might generate significant economic growth for developing countries (Roosta *et al*., 2017). In considering the growing demand for herbal medicine and the conservation imperatives associated with wild harvesting, large-scale MAP cultivation must be encouraged in order to ensure the sector's survival (Chauhan *et al*., 2013; Phondani *et al*., 2016; Roosta *et al*., 2017). The traditional knowledge base that is related with the depletion and loss of MAP diversity may have a substantial effect on human livelihood and health. Therefore, in order to ensure long-term sustainability and preserve this priceless natural resource for future generations, it is imperative that the genetic pool of this richness be protected. In the herbal sector, India has become a prominent destination, boasting the biggest global share of 8.13% and the fastest growth rate of 22% (Maitra and Satya, 2009). Thus, MAP conservation and cultivation have enormous potential for the nation's advancement, wealth, food security, and overall health.

Material and Methods

Study area

The herbal garden was situated at the Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India. The herbal garden is situated in the southeastern part of the state. It lies at 21°76′ N lat., 81°36′ E long. at an altitude of 295 m msl. The climate of the herbal garden is dry sub-humid tropical with an average rainfall of 1250 mm. Most of the rainfall (90%) is received during monsoon season from mid June to mid September. The mean monthly maximum temperature ranges from 25.9 ºC to 34.5ºC in the month of July to March and the minimum temperature 10.3ºC in January. Maximum relative humidity varied from July to December while, minimum relative humidity was recorded during January and March. The soil of herbal garden of belongs in order of Entisols, Alfisols, Inceptisols and Vertisols. The black clayey (Vertisols) soil of herbal garden is locally known as Kanhar. This Kanhar soil are characterized by fine texture, sticky nature, angular blocky structure (Lal and Naugraiya, 2019; Lal *et al*., 2022; Lal and Naugraiya, 2022a, b,c; Tirkey *et al*., 2022a, b).

Data collection

A field survey was conducted in the month of October 2022 for estimation of plant diversity of medicinal and aromatic plants (MAPs). Data of the medicinal and aromatic plants and their uses were collected through discussions with the herbal practitioners of the study area (Loganathan and Selvam, 2018). Botanical name, local name, family and uses of MAPs were noted and MAPs classification list was prepared. The location map was prepared by ArcGIS 10.4 software (Fig. 1).

Results and Discussion

The composition of medicinal and aromatic plants (MAPs) in Herbal Garden

Data on composition of medicinal and aromatic plants (MAPs) in Herbal Garden is given in Table 1. Thirty-seven species represented by 19 families in tree species,

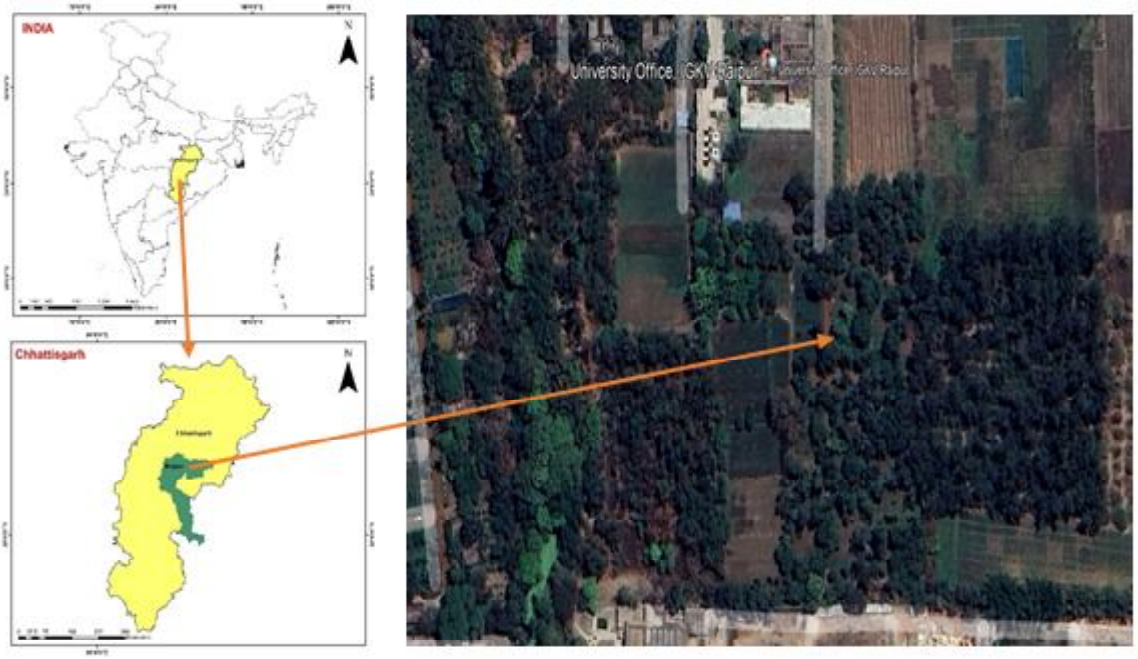

Fig. 1 : Location map of *Ex-situ* conservation of MAPs.

Table 1 : List of *ex-situ* conservation of medicinal and aromatic plants of Herbal Garden, IGKV Campus, Raipur.

S. no.	Common name	Botanical name	Family	Part used	Uses
Tree species					
1.	Safed siris	*Albizia procera* (Roxb.) Benth.	Fabaceae	Leaves, Bark	Tannins and a reddish gum, ulcers
2.	Kala siris	*Albizia lebbeck* (L.) Benth.	Fabaceae		Treating asthma, colds, coughs, and other allergic diseases
3.	Maida	*Litsea glutinosa* (Lour.) C.B.Rob.	Lauraceae	Wood	Making agricultural tools, root fiber for making ropes and paper pulp, young leaves for fodder, seed oil for making candles, soaps and seed powder for treating skin boils.
4.	Beeja	*Pterocarpus marsupium* Roxburgh	Fabaceae	Leaves, Bark	Astringent, anti-diarrhoeal, and anti-haemorrhagic properties,boils, sores and other skin diseases, while flowers are febrifuge.
5.	Shisham	*Dalbergia sissoo* Roxb.	Fabaceae		Sore throats, dysentery, syphilis, bronchitis, inflammations, infections, hernia, skin diseases and gonorrhoea
6.	Reetha	*Sapindus mukorossi* Gaertn.	Sapindaceae	Seed	Remove tan and freckles from the skin
7.	Mangium	*Acacia mangium* Willd.	Fabaceae	Wood	Pulp, firewood, charcoal, construction material
8.	Peepal	*Ficus religiosa* L.	Moraceae	Leaves, bark, seeds and fruits	Asthma, diabetes, diarrhea, epilepsy, gastric problems, inflammatory disorders, infectious and sexual disorders
9.	Rakt Chandan	*Pterocarpus santalinus* L.f.	Fabaceae	Heartwood	Inflammation, diabetes, headache, skin diseases, and jaundice, and in wound-healing.
10.	Sandalwood	*Santalum album* L.	Santalaceae	Heartwood	Antipyretic, antiseptic, antiscabetic, and diuretic properties, bronchitis, cystitis, dysuria, and diseases of the urinary tract
11.	Imli	*Tamarindus indica* L.	Fabaceae	Fruit pulp	Laxative effects and fight against certain fungi and bacteria
12.	Lasoda	*Cordia dichotoma* G. Forst.	Boraginaceae	Leaves	Fever, headache and joint pain
13.	Dahiman	*Cordia macleodii* Hook.	Boraginaceae	Leaf, bark, seed	Healing wounds, mouth sores, treating jaundice, aphrodisiac
14.	Kutaj	*Holarrhena antidysentrica* Wall.	Apocynaceae	bark	Treatment of constipation, colic, and diarrhoea, antimicrobial, anti-inflammatory and analgesic
15.	Rohni	*Catharanthus roseus*(L.) G.Don	Apocynaceae	Root, leaves	Cancer and diabetes, fever, menorrhagia
16.	Shivnak	*Oroxylum indicum* (L.) Benth. ex Kurz	Bignoniaceae	Root bark	Astringent, tonic, anti-diarrhoeal, diuretic, anodyne, and is used to cure dropsy

Table 1 continued....

Table 1 continued....

17.	Champa	*Plumeria* spp.	Apocynaceae	Flowers and bark	Fever, bacillary dysentery, pertussis
18.	Karanj	*Millettia pinnata* (L.) Panigrahi	Fabaceae	Seed, root	Tumours, piles, skin diseases, and ulcers, gonorrhoea, cleaning gums, teeth and ulcers, and is used in vaginal and skin diseases
19.	Kullu	*Sterculia urens* Roxb.	Malvaceae	Gum	Pharma, health care, food, cosmetics, waste management, paper-textile, composite fiber and leather industries
20.	Bel	*Aegle marmelos* (L.) Corrêa	Rutaceae	Fruits	treat diabetes, respiratory problem, inflammation, dysentery and diarrhoea
21.	Simarubra	*Simarouba glauca* DC.	Simaroubaceae	Bark	Diarrhoea, stomach upset, malaria
22.	Kanak champa	*Pterospermum acerifolium* (L.) Willd.	Malvaceae	Flower	Cure for inflammation, ulcers, blood problems, and even tumours
23.	Mahohani	*Swietenia macrophylla* King	Meliaceae	Fruit	Improvement of blood circulation and skin condition
24.	Jamun	*Syzygium cumini* (L.) Skeels.	Myrtaceae	Bark	Treatment of sore throat, bronchitis, asthma, thirst, biliousness, dysentery and ulcers. It is also a good blood purifier.
25.	Char	*Buchanania lanzan*	Anacardiaceae	Seed	Expectorant and tonic,
26.	Kusum	*Schleichera oleosa* (Lour.) Oken	Sapindaceae	Fruits	Antimicrobial, antioxidant, anticancer activity, and can be used for the production of biodiesel
27.	Paras pipal	*Thespesia populnea* (L.) Sol. ex Corrêa	Malvaceae	Bark, root, leaves, flowers and fruits	Skin problems, dysentery, cholera, haemorrhoids, liver and gall bladder problems, urethritis, gonorrhoea, rheumatism and high blood pressure.
28.	Sami	*Prosopis cineraria* (L.) Druce	Fabaceae	Leaves	Leprosy, dysentery, asthma, leucoderma, dyspepsia and earache
29.	Pagara	*Erythrina suberosa* Roxb.	Fabaceae	Bark	Antiseptic
30.	Kachnar	*Bauhinia variegate* (L.) Benth.	Fabaceae	Root, dried buds	antidote to snake poison, dyspepsia, piles, dysentery, diarrhoea and worms
31.	Mamphal	*Annona muricata* L.	Annonaceae	Leaves and fruits	Cancer
32.	Semal	*Bombax ceiba* L.	Malvaceae	Bark	Cholera, tubercular fistula, coughs, urinary complaints, nocturnal pollution, abdominal pain due to dysentery, and impotency
33.	Baheda	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae	Fruits	Protect the liver and to treat respiratory conditions, including respiratory tract infections, cough, and sore throat
34.	Harra	*Terminalia chebula*	Combretaceae	Fruits	Oral ulcers, sore throat

Table 1 continued....

Table 1 continued....

35.	Gugal	*Commiphora wightii* (Arn.) Bhandari	Burseraceae	Gum	Anti-inflammatory and efficacious in the treatment of arthritis, rheumatism, hyperlipidemia, thrombosis and hypercholesterolemia.
36.	Areca palm	*Areca catechu* L.	Arecaceae	Leaves and Nut	Diarrhoea, dropsy, sunstroke, beriberi, throat inflammations, edema, and urinary disorders
37.	Sinduri	*Bixa orellana* L.	Bixaceae	Seed	Antipyretic, aphrodisiac, antidiarrheal, antidiabetic, and insect repellent.
Shrub species					
1.	Adusa	*Adhatoda vasica* Nees	Acanthaceae	Root and leaves	Headache, colds, cough, whooping cough, fever, asthma, dyspnoea, phthisis, jaundice, chronic bronchitis, and diarrhoea.
2.	Chitrak	*Plumbago zeylanica* L.	Plumbagina-ceae	Leaves and root	Migraine, jaundice, skin diseases, urinary calculi, seminal weakness, and internal abscesses
3.	Musk rose	*Rosa moschata* Herrm.	Rosaceae	Young shoot	Provide powerful antioxidant protection
4.	Rosemary	*Rosmarinus officinalis* L.	Lamiaceae		Headache, dysmenorrhoea, stomach-ache, epilepsy, rheumatic pain, spasms, nervous agitation, improvement of memory, hysteria, depression, as well as physical and mental fatigue
5.	Geranium	*Pelargonium*	Geraniaceae		Reduce cold symptoms
6.	Umbrella tree	*Pandanus odorifer* (Forssk.) Kuntze	Pandanaceae	Flowers	Food flavour and in aromatic industry
7.	Nirgundi	*Vitex negundo* L.	Lamiaceae	Leaves and fruits	Anti-inflammatory, antibacterial, antifungal, antimicrobial, antioxidant, and anticancer properties
8.	Bada chandrica	*Rauvolfia tetraphylla* L.	Apocynaceae	Root	Hypertension, cardiovascular diseases and as a tranquilizing agent
9.	Sarpgandha	*Rauvolfia serpentina* (L.) Benth. *Ex* Kurz	Apocynaceae	Root	High blood pressure and also as sedative and tranquillizing agent
10.	Bajradanti	*Barleria* L.	Acanthaceae	Root, bark and leaves	Root is placed on boils and glandular swellings; the bark is used for dropsy and the leaf for toothache and rheumatism
11.	Gataran	*Caesalpinia Crista* L.	Caesalpinia-ceae	Root, stem, leaves and seed	Anthelmintic, anti-inflammation, analgesic activity, antioxidant, anti-tumour, anti-malarial activity
12.	Bharangi	*Clerodendran indicum*	Verbenaceae	Roots and leaves	Stomachic, expectorant, anti-inflammatory, anti-bronchitis, febrifuge, hence useful for asthma, cough, and scrofulous affections, tumours and certain skin diseases
13.	Meetha neem	*Murraya koenigii* (L.) Sprengel	Rutaceae	Leaves	Treating piles, inflammation, itching, fresh cuts, dysentery, bruises, and edema.

Table 1 continued....

Table 1 continued....

14.	Thuja	*Thuja occidentales* L.	Cupressaceae	Leaves and Bark	Liver diseases, bullous bronchitis, psoriasis, enuresis, amenorrhea, cystitis, uterine carcinomas, diarrhoea, and rheumatism, insecticide
15.	Henna	*Lawsonia inermis* L.	Lythraceae	Leaves	Dye for skin, hair, and fingernails, as well as fabrics—silk, wool, and leather
Herb species					
1.	Buch	*Acorus calamus* L.	Acoraceae	Rhizome	Cough, Mental stress, neurological, gastrointestinal, respiratory, metabolic, kidney, and liver disorders.
2.	Kali haldi	*Curcuma caesia* Roxb.	Zingiberaceae	Rhizome	Leukoderma, asthma, tumours, piles, bronchitis, etc.
3.	Amahaldi	*Curcuma amada*	Zingiberaceae	Rhizome	
4.	Kanghi	*Abutilon indicum* (L.) Sweet	Malvaceae	Seed	Laxative, emollient, analgesic, anti-diabetic, anti-inflammatory, blood tonic, leprosy, urinary disease, jaundice, piles, relieving thirst, cleaning wounds and ulcers, vaginal infections, diarrhoea, rheumatism
5.	Patchouli	*Pogostemon cablin* (Blanco) Benth.	Lamiaceae	Entire plant	Treat colds, headaches, fever, nausea, vomiting, diarrhea, abdominal pain, insect and snake bites, Perfume, Soap, tabaco industry
6.	Tikhur	*Curcuma angustifolia* Roxb.	Zingiberaceae	Rhizome	Soothe coughs. Bronchitis, Starch extraction
7.	Jimikand	*Amorphophallus canpanulatus* (Roxb.) Blume ex Decne	Araceae	Tuber	Cough, asthma and liver disorder
8.	Kali musli	*Curculigo orchioides* Gaertn.	Hypoxidaceae	Root	Rejuvenating tonic, aphrodisiac drug, and diuretic
9.	Safed musli	*Chlorophytum borivillanum* Santapau & R.R.Fern.	Asparagaceae	Root	Increase general body immunity, increase male potency
10.	Insulin plant	*Costus igneus* N.E.Br.	Costaceae	Leaves	Helps lower the blood glucose levels, and diabetics
11.	Keokand	*Costus speciosus* (J. Konig) C. Specht	Costaceae	Tuber	Pneumonia, constipation, skin diseases, fever, asthma, bronchitis, inflammation, anaemia, rheumatism, dropsy, cough, urinary diseases and jaundice
12.	Sudarshan	*Crimum defixum*	Amaryllida-ceae	Root	Cough, fever, Skin disease, painkiller, pain in ear
13.	Gurmar	*Gymnema sylvestre* R. Br.	Apocynaceae	Leaves	Suppresses the taste of sugar and reduces sugar cravings
14.	Long pepper	*Piper longum* L.	Piperaceae	Fruit	Anti-inflammatory, Vaat disease, treat chronic bronchitis, asthma, constipation, gonorrhoea, paralysis of the tongue, diarrhoea, cholera, chronic malaria, viral hepatitis, respiratory infections, stomach-ache, bronchitis, diseases of the spleen, cough, and tumours.

Table 1 continued....

Table 1 continued....

15.	Gandhpri-yangu	*Paederia scandens* (Lour.)	Rubiaceae	Leaves	Toothache, chest pains, piles, and spleen inflammation
16.	Safed aprajita	*Clitoria ternatea* L.	Fabaceae	Seed and root	Memory enhancer, nootropic, antistress, anxiolytic, antidepressant, anticonvulsant, tranquilizing and sedative agent
17.	Vidhara	*Argyreia nervosa* (Burm.f.) Bojer	Convolvula-ceae	Leaves and root	Treat sexual disorders, skin disorders, nootropics, ulcers, gonorrhoea, diabetes
18.	Jangaliadrak	*Zingiber officinale* Roscoe	Zingiberaceae	Rhizome	Spice, diabetes, catarrh, asthma, rheumatism, stroke, gingivitis, toothache, constipation, and nervous system diseases
19.	Van haldi	*Curcuma aromatic* Salisb.	Zingiberaceae	Rhizome	Skin disorders and antibacterial agent
20.	Turmeric (Indira Haldi-1)	*Curcuma longa* L.	Zingiberaceae	Rhizome	Chronic diseases and especially of diabetes mellitus (DM)
21.	Jangli lahsoon	*Alium porrum*	Amaryllidaceae	Tuber	Blood purification
22.	Jangali pyaj	*Scilla indica*	Asparagaceae	Tuber	Skin cancer
23.	Coleus	*Coleus barbatus* Benth. ex G. Don	Lamiaceae	Root	analgesic, ophthalmic, and febrifuge
24.	Gulbakawli	*Hedychium coronarium* J. Koenig	Zingiberaceae	Flower	Eye diseases
25.	Aloe vera	*Aloe barbadensis* Mill.	Asphodela-ceae	Leaves	Acne, lichen planus (a very itchy rash on the skin or in the mouth), oral submucous fibrosis, burning mouth syndrome, burns, and radiation-induced skin toxicity.
26.	Punarnaava	*Boerhavia diffusa* L. nom. cons.	Nyctaginaceae	Entire plant	Inflammation, jaundice, asthma, rheumatism, nephrological disorders, ascites, anemia, and gynecological disorders
27.	Brahmi	*Bacopa monnieri* (L.) Pennell	Plantaginaceae	Entire plant	Memory improvement, insomnia, epilepsy, and as an anxiolytic
28.	Bhringraj	*Wedelia chinensis* (Osbeck) Merr.	Asteraceae	Entire plant	Hair enhancer, snake bite and rheumatic disease
29.	Mandukparni	*Centella asiatica* (L.) Urban	Apiaceae	Entire plant	Heal wounds, improve mental clarity, and treat skin conditions such as leprosy and psoriasis
30.	Dronpushpi	*Leucas cephalotes* (Roth) Spreng.	Lamiaceae	Leaves and fruit	Snake bite, cough, fever scorpion stings
31.	Jangali Ajavyan	*Seseli indicum* Wight and Arn.	Apiaceae	Entire plant	Anthelmintic and skin disease

Table 1 continued....

Table 1 continued....

32.	Kapur kachari	*Hedychium spicatum* Sm. in A. Rees	Zingiberaceae	Tuber	Snake bite, stomach pain and hair growth
33.	Ashwagan-dha	*Withania somnifera* (L.) Dunal	Solanaceae	Root	Relieves Stress and Anxiety, Lowers Blood Sugar and Fat, Increases Muscle and Strength, Improves Sexual Function in Women, Boosts Fertility and Testosterone Levels in Men, Sharpens Focus and Memory, Supports Heart Health
34.	Tulsi	*Ocimum sanctum* L.	Lamiaceae	Entire plant	Hand sanitizer, mouthwash and water purifier as well as in animal rearing, wound healing, the preservation of food stuffs and herbal raw materials and traveler's health
35.	Akarkara	*Spilanthes acmella*	Asteraceae	Leaves, flowers	Anti-inflammatory, diuretic, and aphrodisiac effects
36.	Mithi tulsi	*Stevia rebaudiana* (Bertoni) Bertoni	Asteraceae	Entire plant	Anti-hypertensive, anti-obesity, anti-diabetic, antioxidant, anti-cancer, anti-inflammatory, and antimicrobial effects and improvement of kidney function
37.	Japani pudina	*Mentha arvensis* L.	Lamiaceae	Leaves	Hypertension and ischemic heart disease
38.	Mentha	*Mentha piperita* L.	Lamiaceae	Leaves	Hypertension and ischemic heart disease
39.	Bhui amla	*Phyllanthus niruri* L.	Phyllantha-ceae		Jaundice, gonorrhoea, frequent menstruation, and diabetes and topical use as a poultice for skin ulcers, sores, swelling, and itchiness
40.	Kalhari	*Gloriosa superba* L.	Colchicaceae	Rhizome	Tonic, anti-periodic, anti- helminthic and also against snake bites & scorpion stings
41.	Kasondi	*Acalypha indica* L.	Euphorbiaceae	Entire plant	Anti-inflammatory property and analgesic effects. The leaves have strong anthelmintic property
42.	Milk thisal	*Silybum marianum* (L.) Gaertn.	Asteraceae	Entire plant	Treat kidney, spleen, liver, and gallbladder diseases
43.	Badi Ilaichi	*Amomum subulatum* Roxb.	Zingiberaceae	Seed	Skin diseases like eczema and ringworm, headache, reduce foul breath
44.	Ratti lal	*Abrus precatorius*	Fabaceae	Seed, leaves	Treat tetanus, and to prevent rabies, fever, cough and cold
45.	Junglidhaniya	*Eryngium foetidum* L.	Apiaceae	Leaves	Burns, earache, fevers, hypertension, constipation, fits, asthma, stomach ache, worms, infertility complications, snake bites, diarrhoea and malaria.
46.	Chirchita	*Achyranthes aspera* L.	Amarantha-ceae	Entire plant	Treatment of boils, asthma, in facilitating delivery, bleeding, bronchitis, debility, dropsy, cold, colic, cough, dog bite, snake bite, scorpion bite, dysentery, earache, headache, leukoderma, renal complications, pneumonia, and skin diseases
47.	Safed bhringraj	*Eclipta prostrata* L.	Asteraceae	Entire plant	Treatment of skin problems, hepatic problems such as jaundice, gastrointestinal problems, respiratory problems such as asthma, and other symptoms such as fever, hair loss and whitening of hair, cuts, and wounds, spleen enlargement, etc.
Grasses					
1.	Lemon grass (Pragati)	*Cymbopogan flexuosus* W. Watson	Poaceae	Entire plant	Antispasmodic, hypotensive, anticonvulsant, analgesic, antiemetic, antitussive, antirheumatic, antiseptic and treatment for nervous and gastrointestinal disorders and fevers

Table 1 continued....

Table 1 continued....

2.	Lemon grass (Praman)	*Cymbopoganf lexuosus* W. Watson	Poaceae	Entire plant	Antispasmodic, hypotensive, anticonvulsant, analgesic, antiemetic, antitussive, antirheumatic, antiseptic and treatment for nervous and gastrointestinal disorders and fevers
3.	Palmarosa (PRC-1)	*Cymbopogan martini* (Roxb.) Wats.	Poaceae	Entire plant	Antimicrobial properties, Skin tonic, Agarbatti, Soap and cosmetics
4.	Lemon grass	*Cymbopogan citratus* (DC.) Stapf	Poaceae	Entire plant	Improve digestion, nausea and menstruation problems and ailments like headaches, muscle cramps, spasms and rheumatisms.
5.	Citronella	*Cymbopogan winterianus* Jowitt ex Bor	Poaceae	Entire plant	Perfumery products and cosmetics, a source of Citronella oil
6.	Khus	*Chrysopogon zizanioides* (L.) Roberty	Poaceae	Entire plant	Relieving stress, as well as for emotional traumas and shock, lice, and repelling insects
Climbers					
1.	Satavar	*Asparagus recemosus* Willd.	Asparagaceae	Tuber	Prevention and treatment of gastric ulcers, dyspepsia and as a galactogogue
2.	Dum bel	*Tylophora indica*	Asclepiada-ceae	Leaves	Asthma
3.	Giloy	*Tinospora cordifolia* (Thunb.) Miers	Menisperma-ceae	Stem, root and leaves	Improves platelet count in dengue fever and reduces the chances of complications, improve immunity
4.	Kewach	*Mucuna prurient s* (L.) DC.	Fabaceae	Seed	Anti-parasitic, anti-microbial, antioxidant, anti-inflammatory anti-venom and ant-debility (physical weakness)
5.	Malkangani	*Celastrus paniculatus*. Willd	Celastraceae	Seed	Alleviate cognitive issues and promote intestinal health, piles, white spots, asthma etc
6.	Anantmul	*Hemidesmus indicus* (L.) R.Br.	Apocynaceae	Root and bark	Leprosy, skin diseases, fever, asthma, bronchitis, syphilis, pruritus and other urinary diseases, chronic rheumatism, and leucorrhoea
7.	Harjor	*Cissus quadrangularis* L.	Vitaceae	Stem and leaves	Diabetes, obesity, high cholesterol, bone fractures, allergies, cancer, stomach upset, painful menstrual periods, asthma, malaria, wound healing, peptic ulcer disease, weak bones, weak bones (osteoporosis)
8.	Betel	*Piper betle* L.	Piperaceae	Leaves	Prevents halitosis, improves vocalization, and strengthens gum, treat indigestion, constipation, congestion, coughs and asthma
9.	Black pepper	*Piper nigrum* L.	Piperaceae	Seeds and fruits	Menstrual and ear-nose-throat disorders in human and gastrointestinal disorders in livestock, pills or tablets, and paste
10.	Priyangu	*Callicarpa macrophylla* Vahl	Lamiaceae	-	Tumour, polydipsia, diarrhoea, dysentery, diabetes, fever, etc.

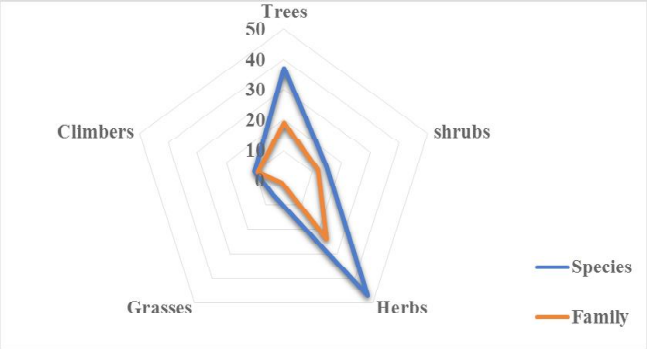

Fig. 2 : Species composition and their families in Herbal Garden.

fifteen species represented by 12 families in shrubs, forty-seven species represented by 24 families in herb species, six species represented by one family in grasses and ten species represented by 9 families in climbers were found in herbal garden (Fig. 2). The most abundant families of tree species were Fabaceae are represent with eleven species followed by Malvaceae (representing four species) and Apocynaceae (representing three species), The most abundant families of shrub species were Lamiaceae, Apocynaceae and Acanthaceae each are representing two species, in case of herb species most abundant families are Zingiberaceae (representing nine species) followed by Lamiaceae (representing six species), Asteraceae (representing five species) and Apiaceae (representing three species). Poaceae is the most abundant families of grasses. In case of climbers Piperaceae is abundant family (Table 1).

Ex-situ conservation of Medicinal and Aromatic plants in Herbal garden

Data on *ex-situ* conservation of medicinal and aromatic plants (MAPs) in Herbal Garden is given in Table 1. The important tree species are *Litsea glutinosa* (Lour.) C.B.Rob., *Sapindus mukorossi* Gaertn., *Pterocarpus santalinus* L.f., *Santalum album* L., *Cordia dichotoma* G.Forst., *Cordia macleodii* Hook., *Holarrhena antidysentrica* Wall., *Oroxylum indicum* (L.) Benth. ex Kurz, *Annona muricata* L., *Terminalia bellirica* (Gaertn.) Roxb. and *Terminalia chebula* etc. The important shrub species are *Adhatoda vasica* Nees, *Plumbago zeylanica* L., *Rauvolfia serpentina* (L.) Benth. *Ex* Kurz, *Rauvolfia tetraphylla* L. and *Caesalpinia crista* L. etc. Important herb species are *Curculigo orchioides* Gaertn., *Costus igneus* N.E.Br., *Costus speciosus* (J. Konig) C. Specht, *Crimum defixum*, *Paederia scandens* (Lour.), *Clitoria ternatea* L., *Hemidesmus indicus* (L.) R.Br., *Bacopa monnieri*(L.) Pennell, *Withania somnifera* (L.) Dunal, and *Stevia rebaudiana* (Bertoni) Bertoni etc. The important grasses are found *Cymbopogan flexuosus*W. Watson, *Cymbopogan martini* (Roxb.) Wats., *Cymbopogan citrates* (DC.) Stapf and *Cymbopogan winterianus* Jowitt ex Bor. The important climber species are *Asparagus recemosus* Willd., *Tylophora indica*, *Tinospora cordifolia* (Thunb.) Miers, *Cissus quadrangularis* L., *Celastrus paniculatus* Willd. and *Hemidesmus indicu s*(L.) R.Br. etc. The list of *ex-situ* conservation of MAPs and their uses are described in Table 1.

Conclusion

Medicinal and Aromatic Plants (MAPs) are important for human health and treatment of various types of diseases. The *ex-situ* conservation is very important for cultivation, conservation and sustainable uses of MAPs. In addition to serving as a significant source of raw materials for traditional medicine and the herbal company, medicinal plants support a significant portion of the Indian population's livelihood and guarantee their health. The non-sustainable method was used in harvesting of medicinal plants in natural forest is very dangerous and causes loss of diversity of MAPs. The *ex-situ* conservation, cultivation practices and sustainable method is very important for conservation and development of medicinal and aromatic plants.

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