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A Study on Aromatic plants: Diversity, Identification and Application of Pathribagh area in Dehradun, Uttarakhand, India

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Abstract
Aromatic plants have performed a significant role in human health and well-being since ancient times. These plants produce primarily volatile compounds, used in numerous industries including food, pharmaceuticals, and liquor. The essential oils derived from these plants have been found to possess several biological activities especially antiviral, antibacterial, antifungal, insecticidal, and antioxidant properties. The present study focuses on the documentation and analysis of aromatic plant species found within the agricultural fields of Shri Guru Ram Rai University, Pathribagh Campus, Dehradun, Uttarakhand. A total of 20 aromatic plant species belonging to 7 families were identified in the study area. Maximum amount (80%) were herb, 15% shrub and only 5% were trees. These plants are known for producing essential oils with secondary metabolites, which have utilization in the food, pharmaceutical, and cosmetic industries. These plants also hold significant value due to their therapeutic properties and their role in traditional medicine and aromatherapy. The data gathered aims to support further research and promote the sustainable use of aromatic plants for commercial and medicinal purposes.

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INTRODUCTION

With its enormous ecological diversity from sea level to the highest mountains, India stands as one of the most diverse country in the world. India accounts for about 2.4% of the world's total landmass, yet account for majority of global biodiversity and one of the 17 mega diversity country in the world (Singh & Dash, 2014). India contributes 11.4% global flora and about 7-8% global biodiversity (Karthikeyan, 2009, Singh *et al.*, 2021). Studies conducted by Samant (2003) showed that 1748 species were endemic to Himalayas and about 493 species were exotic indicating their ability to establish in diverse environmental conditions (Jain, 1968, Singh *et al.*, 2021). It has been estimated that about 30% of drugs used in pharmaceutical industries are derived from green plants and this percentage has increased considerable in recent years. India has around 8,000 species used as medicinal plants and in the traditional system of medicine viz., Ayurveda,

Unani and Siddha, about 1,000 plants have been used. These plants are also used in the preparation of herbal and value added products and consumer items (Chopra and Chopra, 1956, Joy *et al*., 2001, Patel, 2016, Mathe, 2015, Sharafi *et al*., 2010).

Essential oils have a major impact on human existence, whether directly or indirectly from the beginning of civilization (Hussain *et al.,* (2008). Aromatic plants are known to contain various types of phyto-constituents responsible for distinct odors and biological potentials (Couladis *et al*., 2003, Heim, 2002, Pandey *et al*., 2020). Aromatic plants provide significant advantages to human society because they are inexpensive, easy to find, and have unique characteristics. They are natural, sustainable, and generally recognized as nontoxic, making them highly valued in various aspects of daily life (Bakkali *et al.,* 2008). As interest in these plants continues to grow, they present promising revenue-generating opportunities, particularly for rural communities. However, despite their values, aromatic plants are often neglected and inadequately protected. In light of these realities, it is imperative to prioritize the preservation of aromatic plants to ensure their availability and benefits for future generations. Many of them are used also for aromatherapy purposes and for health care systems (Maiti *etal.*,2007, Miguel, 2010, Zheng and Wang, 2001). This study was initiated to assess the diversity of aromatic plants, its taxonomic identification along with its applications at Agricultural field of Shri Guru Ram Rai University, Pathribagh Campus, Dehradun, Uttarakhand.

MATERIAL AND METHODS

Location and climatic conditions:

The present study was conducted at Agricultural field of School of Agricultural Sciences, Shri Guru Ram Rai University, Pathribagh campus of 48.6 acres. Dehradun district is located between the latitude 29°55′ and 38°31′ N and longitude 77°35′ and 78°20′ with an elevation of 650 m above sea level. The aromatic plants were collected from the field, which were growing under natural conditions with proper cultivation practices. The campus receives an average rainfall of 1200-1300 mm of which 75% is during the rainy season only. In December and January, it receives winter rainfall. The soil is alluvial and highly fertile.

Collection and identification of plant material

Plant materials were collected from agricultural field of Pathribagh campus of SGRRU. Identification of plant is done by considering the morphological characters and reproductive features of the plants. Habitat was noted during the field study of SGRR campus.

Figure 1: Studied area - Shri Guru Ram Rai University, Pathribagh Campus, Dehradun, Uttarakhand

Each plant species were illustrated and taxonomic details compared and submitted for identification in Department of Botany, School of Basic and Applied Sciences, SGRR University, Dehradun, Uttarakhand, India.

RESULT AND DISCUSSION

Aromatic plants are plants that contain aromatic compounds, or essential oils, which are volatile at room temperature. The studied area for the present study on aromatic plants was Pathri bagh Campus of SGRR University, Dehradun. 20 Aromatic plants from the campus belongs to 7 families which were as follows: Asteraceae, Lamiaceae, Myrtaceae, Poaceae, Rosaceae, Rutaceae and Zingiberaceae (Table 2 and figure 2). 80% plants were herb, 15% shrub and remaining 5% were trees (Figure 3). These are mainly used for their aroma and flavor as essential oil contains phenols, flavonoids, terpenes (Maiti *et al*., 2007, Chun *et al.,* 2005, Lambert, 2000). Essential oils can be used to treat infectious diseases, and may be an alternative to synthetic biological active compounds (Dorman, and Deans, 2000, Panghal *et al.,* 2011). They can also be used to protect crops and indoor plants, and as insect repellents. Essential oils can be used to treat a variety of illnesses, including depression, anxiety, and pain. They can also improve mood, sleep, and job performance. Besides these application, Essential oils are used in cosmetics, perfumes, aromatherapy, and more. They can also be used as food preservatives and additives, and in animal nutrition (Bowles and Miller, 1993, Benchaar, 2008, Franz *et al.,* 2010).

Essential oils are complex mixtures of bioactive ingredients, including terpenes, phenol, and sulfur-containing compounds. Essential oils can contribute to odor and ammonia control. Plants with their essential oils and their therapeutic uses were listed in table 2 and figure 2.

Table 1: **List of aromatic plants grown in Pathribagh campus with their scientific names, family, and part used**

Plant name	Family	Habit	Part used	Phyto-constituents	Therapeutic uses
Badri Tulsi *(Oreganum vulgare)*	Lamiaceae	Herb	Leaves	Essential oils contains particularly carvacrol and thymol, flavonoids, phenolic acids like rosmarinic acid, and various terpenoids.	Anti- inflammatory and wound healing ability
Basil (*Ocimum basilicum*)	Lamiaceae	Herb	Stem, leaves, flowers, seed	Essential oil contains monoterpenes-linalool, sesquiterpenes, flavonoids, phenolic acids, and fatty acids	Antidepressant, hepatoprotective, anti-diabetic activity.
Bhangjeera *(Perilla frutescens*)	Lamiaceae	Herb	Stem, leaves	Apigenin, ascorbic acid, limonene, luteolin, quercetin, rosmarinic-acid etc.	Used to treat cold, cough, nausea, vomiting, abdominal pain, constipation, asthma, and food poisoning

Chamomile (*Matricaria recutita* L)	Asteraceae	Herb	Flowers	Terpenoids, sesquiterpene lactones, and phenolic compounds, sesquiterpene lactones like matricin etc.	Anti-inflammatory, vulnerary, deodorant, bacteriostatic, antimicrobial, anticatarrhal, carminative, sedative, antiseptic and treating gastrointestinal troubles, including indigestion, diarrhoea, anorexia, motion sickness.
Citronella (*Cymbopogon winterianus* Jowitt Bor)	Poaceae	Herb	Leaves	Geraniol, citronellal, and citronellol	Used as insect repellent
Eucalyptus globus	Myrtaceae	Shrub to tree	Leaves, branch tips	flavonoids, alkaloids, tannins, and propanoids, α-pinene, p-cymene, cryptone and spathulenol	Relieve congestion, coughs, colds, and sinusitis. It can also be used in chest rubs and inhalation therapies.
Holy basil (*Ocimum sanctum*)	Lamiaceae	Herb	Leaves, stalks, flowers	Eugenol, carvacrol, and rosmarinic acid	Essential oils are used in cosmetics, food, and pharmaceuticals as an antiallergic and antimicrobial agent.
Kapoor Kachri *(Hedychium spicatum*)	Zingiberaceae	Herb	Rhizome	saponins, steroids, tannins, glycosides, triterpenoids, albumin, saccharine, and phytosterols	It's rhizome is aromatic and rich in essential oil, have antimicrobial, anti-inflammatory and antioxidant properties
Lamium album	Lamiaceae	Herb	Flowers, leaves	Plant contain choline, glycosides, saponins, mucilage, iridoids, essential oils, triterpenes, isoscutellarein derivatives	Treats stomach and intestinal ulcers, acid reflex and other acid related problems
Lavender (*Lavendula officinalis* L)	Lamiaceae	Herb	Flowers	linalool, linalyl acetate, 1,8-cineole, and camphor	Used as a disinfectant in swabbing of injuries, against burns, insect bites: also as a relaxant, carminative and tranquilizing agent in aromatherapy

Lemon (*Citrus limon*)	Rutaceae	Shrub	Lemon peels	Lavonoids, essential oils, and terpenoids.	It can be used for a variety of skin conditions, including acne
Lemongrass (*Cymbopogon citratus*)	Poaceae	Herb	Leaves	Essential oils with terpenes like citral, geraniol, and linalool, as well as flavonoids, phenolic compounds, and other secondary metabolites like saponins, tannins, and alkaloids	Carminative, antipyretic, antifungal and antibacterial agent
Marigold (*Tagetes erecta*)	Asteraceae	Herb	Flowers	Alkaloids, flavonoids, terpenoids, saponins, glycosides, steroids, and tannins	Rich in antioxidants, which can help reduce inflammation and protect cells from free radicals damage
Mentha citrata	Lamiaceae	Herb	Stem, leaves	Linalool and linalyl acetate, 1,8-cineole, α-terpineol	Used to treat skin, muscle aching , fever, cough
Mentha piperita	Lamiaceae	Herb	Stem, leaves	Menthol, menthone, and various terpenes	Peppermint oil is used for problems like headache, muscle aches, joint pain, and itching. Peppermint is also used for Irritable bowel syndrome(IBS) and other digestive problems
Rose (*Rosa rubiginosa*)	Rosaceae	Shrub	Flowers	organic acids, carotenoids, vitamins, phenols and flavonoids	Used on aromatherapy, perfumery, skincare and stress management
Rosemary (*Rosmarinus officinalis* L.)	Lamiaceae	Herb	Leaves, stalks, flowers	Rosmarinic acid, caffeic acid, carnosic acid etc.	Antimicrobial, antiviral, anti-inflammatory, anti-carcinogenic properties
Ruta graveolens	Rutaceae	Shrub	Leaves	Acridone alkaloids, quinoline alkaloids, coumarins, and furanocoumarins.	Used as a tonic or for the traditional treatment against cold headaches, dementia, and ear pain

Salvia officinalis L.	Lamiaceae	Herb	Leaves	Essential oils, flavonoids, phenolic compounds. camphor, 1,8-cineole, α-thujone, and β-thujone	Mouth and throat inflammation, cure wounds, relieves stomach, liver and rheumatic pain
Van tulsi *(Ocimum gratissimum)*	Lamiaceae	Herb	Flowers	Alkaloids, flavonoids, polyphenols, and terpenoids	The essential oil has antimicrobial activity and can be used to treat acne. It can used in wound dressings and mouthwash.

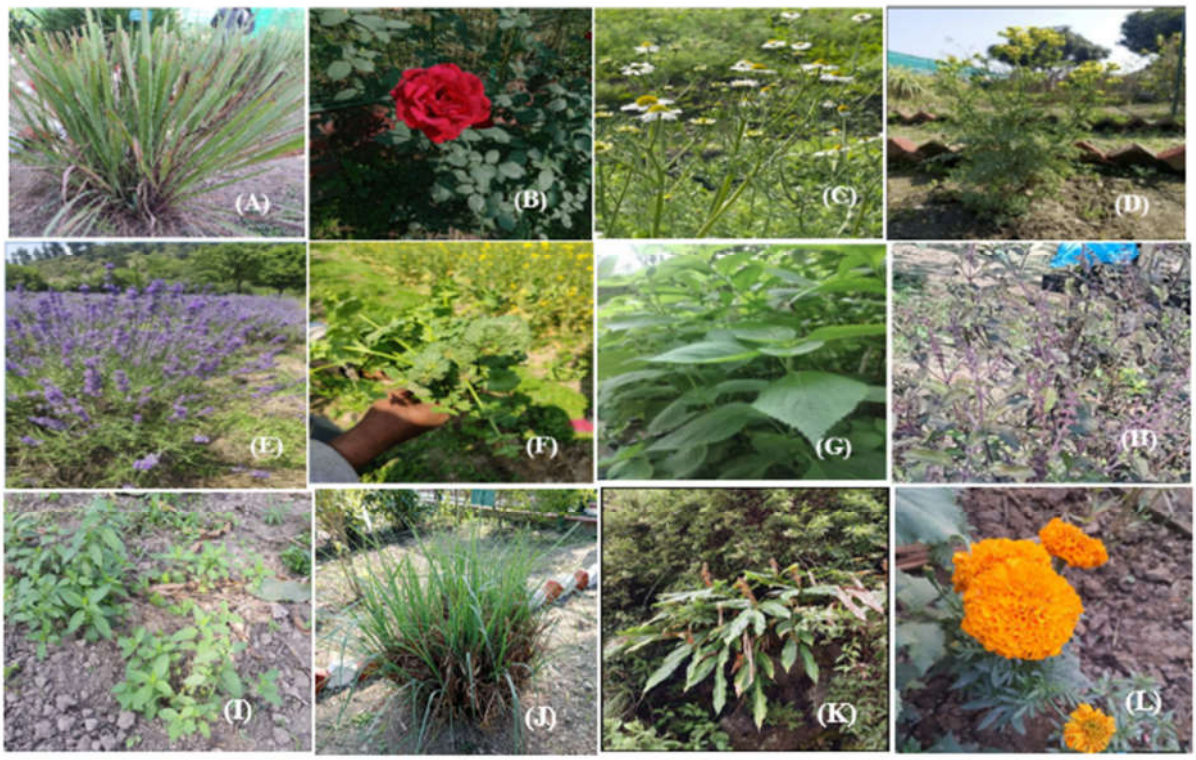

Figure 2: Common Aromatic plants grown in Pathribagh campus- (A) Citronella, (B) Rose, (C) Chamomile, (D) Ruta, (E) Lavender, *(F)* Lamium, (G) Perilla, (H)Tulsi, (I) Mentha , (J) Lemongrass, (K) Kapoor Kachhri, (L) Mary gold

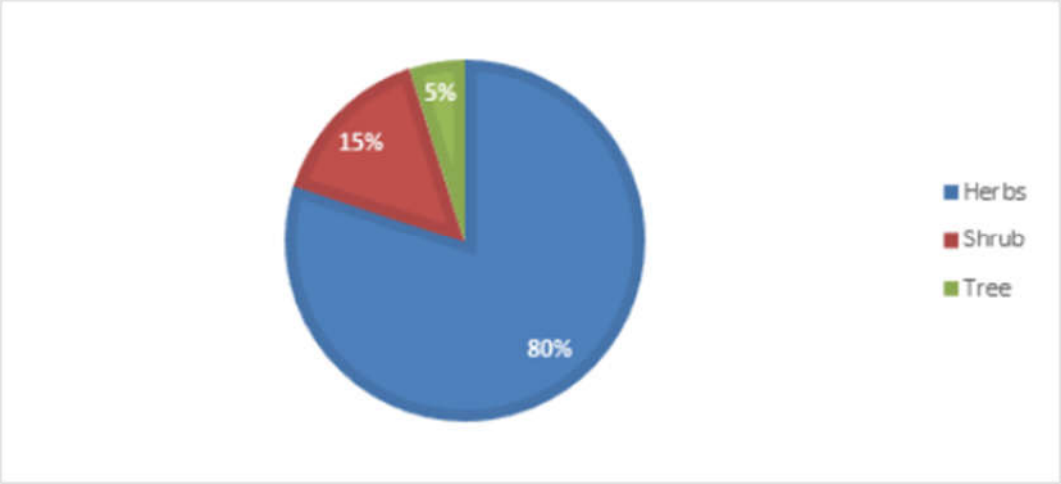

Figure 3: Pie diagram showing habitat of aromatic plants found in Dehradun

CONCLUSION

The present study revealed that in the studied area total 20 aromatic plants belongs to 7 families were reported. These plants have several biological potential - antiviral, nematocidal, antifungal, insecticidal, and antioxidant properties. Essential oils from these plants have many potential benefits as used in making perfumes, in cooking, and in the food, pharmaceutical, and liquor industries. The data gathered aims to support further research and promote the sustainable use of aromatic plants for commercial and medicinal purposes.

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