

IMPORTANT MEDICINAL AND AROMATIC PLANTS OF BARBADOS

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Summary

The Caribbean region is widely recognized for its rich plant diversity and has a long history of using these plants for medicinal remedies and disease management. In Barbados, the convergence of Amerindian, European, and West African cultures and healing traditions during the colonial era is reflected in the local pharmacopeia and traditional medicine practices that prevail on the island today. This chapter details ten of the most important medicinal plants in the traditional herbal healthcare in Barbados.

Each plant is presented in monograph format with information regarding its appearance, distribution, ecology, cultivation and harvesting practices, medicinal importance in a historical context, current medicinal uses in Barbados as well as regions of origin, administration/preparation in Barbados traditional medicine, and pharmacological activities as evidenced by original research. Information was gathered from textbooks, databases, and published primary and secondary research.

1. Introduction

1.1. Medicinal and Aromatic Plants: Current and Historical Perspectives

Medicinal and aromatic plants (MAPs) have been valued by mankind as sources of food and medicine since prehistoric times. Being vulnerable to destruction by microorganisms, animals and insects, plants evolved a range of adaptations to improve their survival, including chemical defenses that act as repellents or toxins to animals, among other actions. These chemical defenses, which exist under the broad category of plant-based “secondary metabolites,” necessitated our ancestors to be selective in which plant parts they consumed and ultimately allowed them to observe that certain plant tissues, such as fruits, leaves, or roots, would alleviate certain health-related ailments. Since these beginnings, accumulated MAP knowledge has been passed from generation to generation, contributing to the advancement of modern civilization.

Unlike the plants’ primary metabolites, which are essential for growth and development, secondary metabolites facilitate the plant’s functions in its interaction with the abiotic and biotic environment. These bioactive compounds are referred as phytochemicals. The eventual isolation and identification of phytochemicals and their associated bioactivities resulted in the discovery of many important drugs that are still used today (e.g., morphine, reserpine, and codeine).

The four major classifications of phytochemicals based on their biosynthetic origin include alkaloids, phenylpropanoids, polyketides and terpenoids. **Aromatic plants** are those that produce and exude aromatic compounds, which are primarily essential oils that comprise phenylpropenes and terpenes and are volatile at room temperature. They are odorous, hydrophobic, and highly concentrated compounds. **Medicinal plants** are those that possess therapeutic properties or exert beneficial pharmacological effects on the human or animal body. It is important to note, however, that not all aromatic plants are considered medicinal.

1.2. Objectives and Scope of the Chapter

Following a brief introduction to the country of Barbados, the remainder of this chapter focuses on the ten most common and culturally important medicinal and aromatic plants in the traditional herbal medicine on the island, as determined based on selection criteria inclusive of reports in published literature, formal local surveys and data gathered from local focus groups. The selected plants include:

1. *Pimenta racemosa* (Mill.) J.W. Moore [Myrtaceae]
2. *Momordica charantia* L. [Cucurbitaceae]

3. *Zingiber officinale* Roscoe [Zingiberaceae]
4. *Annona muricata* L. [Annonaceae]
5. *Aloe vera* (L.) Burm.f. [Asphodelaceae]
6. *Moringa oleifera* Lam. [Moringaceae]
7. *Cymbopogon citratus* (DC.) Stapf [Poaceae]
8. *Petroselinum crispum* (Mill.) Fuss [Apiaceae]
9. *Azadirachta indica* A.Juss [Meliaceae]
10. *Kalanchoe pinnata* (Lam.) Pers [Crassulaceae]

In Section 3, each of these plants is discussed in-depth under the headings:

- a) Alternative Nomenclature
 - ⇒ Common scientific synonyms and vernacular (common/local) names
- b) Main Therapeutic Properties
 - ⇒ Overview of prominent therapeutic properties
- c) Botanical Description
 - ⇒ Habit and external appearance (flowers, fruits, seeds, leaves...)
- d) Distribution and Ecology
 - ⇒ Native origins, global geographic distribution, and environmental preferences
- e) Cultivation/Harvesting Practices
 - ⇒ How the species is typically grown and harvested in the tropics
- f) Background and Medicinal History
 - ⇒ Medicinal importance of the plant from a historical perspective, focusing on early uses in Barbados and the areas of origin
- g) Present-Day Medicinal Uses
 - ⇒ Focuses on the current medicinal uses in Barbados while also mentioning those in the wider Caribbean and native regions, as determined by recent ethnobotanical studies
- h) Preparation and Posology (Table)
 - ⇒ How the plant is traditionally administered as an herbal remedy by Barbadians (under “Local Traditional Practices”) and, when available, established administration guidelines provided by TRAMIL – a Caribbean-wide program of applied research on traditional and popular medicine (under “Established Caribbean Practices”)
- i) Pharmacological Activity (Table)
 - ⇒ Overview of the bioactive compounds involved in certain therapeutic actions, and research supporting traditional uses

Note: while all the included plants are considered medicinal, they are not all aromatics. Thus, those that are both medicinal and aromatic will be designated as such under the *Main Therapeutic Properties* heading in their respective botanical profiles.

2. Barbados

Barbados is the easternmost island of the Caribbean region, located in the lesser Antilles of the West Indies. It was discovered in the 16th century by the Portuguese, who, upon noticing the abundance of Bearded fig trees (*Ficus citrifolia* Mill.) on the island, named it *Los Barbados* – meaning “bearded-ones.” It was uninhabited upon its discovery, but historical notes highlight that it was visited by Amerindian settlers from neighboring territories for food and other natural resources. In 1627, British colonizers arrived and established a lasting settlement on the island. Barbados remained under British rule for over 300 years, only becoming independent in 1966.

2.1. Geography, Climate and Vegetation

Barbados is located in the North Atlantic Ocean at a latitude of 13°10' North and a longitude of 59°32' West – uniquely situated such that the West coast lies in the Caribbean Sea while the North and East coasts lie in the Atlantic. Unlike the neighboring islands – which are volcanic and mountainous – Barbados is coral-based and relatively flat, with the highest point rising to 340 m above sea level.

Due to its location, Barbados has a tropical, oceanic climate with a dry season that lasts from December to May and a wet season the remainder of the year. Average annual temperatures typically range from 24°C to 28°C, and the average rainfall is ~1525 mm annually. In the early days of colonization, there were thousands of plant species on the island; however, due to the mass amounts of deforestation that took place to make room for sugarcane plantations, there are only ~600–700 species of plants that can still be found in the wild today – two of which are considered endemic to the island.

2.2. Health and Welfare

According to the World Health Organization (WHO) Global Health Observatory Data Repository 2018, the life expectancy of Barbadians at birth for males and females is 74.5 and 77.7 years, respectively, while the the adult mortality rate for males and females is 129 and 74, respectively.. In the 2011 United Nations Economic Commission for Latin America and the Caribbean (ECLAC) report, Barbados' life expectancy for both sexes (1950 to 2050) ranked in the top 5 of all territories in the Caribbean and ECLAC member states. Nevertheless, a 2015 Health of the Nation survey found that 1 in 10 adults suffers from a non-communicable disease (NCD), 80% of men and 90% of women have at least one risk factor, and one-third of adults were being managed for at least 1 NCD. As of 2019, NCDs account for 9 of the top 10 causes of death in Barbados. The major communicable diseases affecting Barbadians and the people of the Caribbean include sexually transmitted diseases, tuberculosis, cholera, dengue, zika, chikungunya, malaria, influenza and most recently, the SARS-COV-2.

In terms of healthcare, the 1969 Health Services Act of Barbados, Cap. 44, and the Drug Services Act 1980 provide the framework which ensures that Barbadians receive universal healthcare coverage and access to quality drugs at affordable prices regardless of their socio-economic circumstances. In 2019, health expenditure as a percentage of

the gross domestic product was approximately 6.8 %, which is comparable throughout the rest of the English-speaking Caribbean.

2.3. Knowledge, Attitudes, and Practices of Traditional Medicine

The cultural practices of the inhabitants of the Caribbean have informed historical and current practices of the use of plants as medicines. Current practices emanated from the convergence and hybridization of global, historical traditions inclusive of the indigenous people of the Caribbean, West Africans, European colonizers, and the Asian indentured servants. The naming of the herbal treatments, for example, cooling teas, aligns with cultural syncretism between Eurocentric and Afrocentric healing practices. Other critical factors which informed the use of medicinal plants by inhabitants today includes the deforestation to clear lands for sugarcane and other agricultural crops, the healthcare system of the island, socioeconomics, and religion. Studies in Trinidad and Tobago, Barbados, and Jamaica suggest that persons who are educated and employed are more likely to use conventional medicine than use medicinal plants for ailments, and that the use of botanical remedies is more prevalent among persons in the lower income bracket. Additionally, religious movements have been an important aspect of the cultural impression of the pre- and post-colonial landscape in Barbados and have informed the plant practices of Barbadians due to ideologies and sacraments.

Recent ethnobotanical studies conducted in Barbados have identified over 100 plant species that are used in traditional medicine on the island. In addition to the ten plants detailed in this chapter, other common medicinal and aromatic plants used by Barbadians include *Persea americana* Mill. (Avocado Pear), *Allium sativum* L. (Garlic), *Mentha* sp. (Mint), *Carica papaya* L. (Pawpaw), *Stachytarpheta jamaicensis* (L.) Vahl (Vervain), and *Curcuma longa* L. (Turmeric).

3. Prominent Medicinal and Aromatic Plants in Barbados: Botanical Profiles

3.1. *Pimenta racemosa* (Mill.) J.W. Moore [MYRTACEAE]

Alternative Nomenclature

Common Synonym(s): *Caryophyllus racemosus* Mill.

Vernacular Names: West Indian Bay Leaf, Bay Rum Tree

Main Therapeutic Properties

Aromatic, carminative, digestive, stimulant, antinausea, hypotensive, analgesic.

Botanical Description

Pimenta racemosa (Mill.) J.W. Moore is an evergreen tree between 4 and 12 m tall, with a thin, dark brown trunk. Leaves are obovate to elliptic in shape, dark green, shiny above and dull and pale beneath; when crushed, they are highly aromatic and give off the characteristic “bay rum” odor. Flowers are white, fragrant and have 5 petals, and the fruit is small and globose, turning from green to black when mature.

Distribution and Ecology

P. racemosa is native to the Caribbean basin, although occurrences in mainland Central America and northern South America are also thought to be part of the native range. It is found as an introduced species in some African and Asian countries, including Benin, Ghana, Tanzania, Mayotte, India, Sri Lanka, and in the Pacific Islands.

The Bay Rum Tree is a tree of the humid and sub-humid tropics and sub-tropics, preferring sunny, moist conditions. It is intolerant to frost and full shade, and moderately tolerant of drought, salt, and wind. *P. racemosa* grows best in areas receiving 1000-3000 mm of rainfall annually and tends to be found in open areas or forest edges, at elevations of up to 750 m.

Cultivation/Harvesting Practices

P. racemosa propagation is typically by seed. The seeds are removed from mature fruits and planted within 2 days after washing. Germination occurs in 2-6 weeks and the seedlings are ready for transplanting to the field after 18-24 months. Growth is best on deep, fertile loamy soils that are well-draining with a slightly acidic to neutral pH. After planting the seedlings should be protected from direct sunlight until they are well-established. Once the plants reach 4 years in age, they are harvested once per year. Harvesting can be done year-round, though leaf oil content is often highest during dry periods and periods of warm weather. Harvested leaves can be processed immediately or stored in suitable, well-aerated conditions for up to a week.

Background and Medicinal History

Originating in the Caribbean, the leaves of *P. racemosa* were used by the indigenous people of the Lesser Antilles as a cure for colic and stomach-ache. However, 16th century sailors passing through the West Indies discovered that rubbing the leaves masked bodily odors and was also helpful in treating sunburns. It was later discovered that steeping the leaves in rum made their effects even stronger, which led to the widespread production and use of “Bay Rum.” A bath to which Bay Rum was added was said to strengthen the flesh, take away heat and dryness of the skin, give softness and strength to tired limbs, and produce feelings of invigoration. In the “sick room” it was used to purify and refresh the air and was considered invaluable to travelers as it quickly relieved the feelings of physical and mental weariness from long voyages.

Present-Day Medicinal Uses

In Barbados, *P. racemosa* leaves are commonly used in traditional medicine as a treatment for hypertension, diabetes, headaches, sinus issues, stomach aches, gas, nausea, diarrhea, fever, colds/flu, menopause, and as a sedative. They are also used for culture-bound health purposes in Barbados, including cooling, cleansing, and as a tonic to help restore and invigorate systems in the body. Ethnobotanical surveys conducted in other Caribbean countries have documented additional uses of *P. racemosa* leaves, including as a treatment for toothaches, rheumatism, sprains, and strains.

Preparation and Posology

Indication	Local Traditional Practices	
	Preparation	Administration
Hypertension	Decoction or infusion	Oral – daily
Diabetes	Decoction or infusion	Oral
Headache	Infusion	Oral – as needed
Sinus-related	Decoction	Oral – as needed
Fever	Decoction or infusion	Oral
Colds/flu	Decoction	Oral – as needed
Menopause	Decoction or infusion	Oral
Sedative	Decoction or infusion	Oral
Cooling	Decoction or infusion	Oral – daily or weekly
Cleansing	Decoction with sugar	Oral – monthly
Tonic	Decoction or infusion	Oral
Established Caribbean Practices		
Toothache	Crushed with floral bud of <i>Syzygium aromaticum</i> and clove of <i>Allium sativum</i>	Topical (5-10 g) – apply to affected area 2-3 x/day
Rheumatism	Crushed	Topical (30 g) – rub on affected area 2 x/day for 2-5 mins

Table 1. Preparation and Methods of Administration of *P. racemosa racemosa* (Parts used: Leaf in all cases listed above)

Pharmacological Activity

Local Ethnomedicinal Indications	Bioactive Chemical Profile		Supporting Evidence
	Bioactive Compounds	Plant Part(s)	
Hypertension	Eugenol	EO (L, Fl, B)	Pramod et al., 2010; Criddle et al., 2003; Damiani et al., 2003
Diabetes	Eugenol	EO (L, Fl, B)	Al-Gendy et al., 2017; Anitha et al., 2020; El-Gizawy et al., 2018; Santos et al., 2018
	Myrcene	EO (L, B)	
	Chavicol	EO (L)	
	Limonene	L	
Headache	Eugenol	EO (L, Fl, B)	Pramod et al., 2010; Fernandez et al., 2001b; Rufino et al., 2015
	Myrcene	EO (L, B)	
	Lupeol	L	

Sinus Conditions	Eucalyptol	EO (L)	Cai et al., 2020; Gao et al., 2016; Bastos et al., 2011; Sudhoff et al., 2015
	Eugenol	EO (L, Fl, B)	
	Abietic acid		
Stomach-ache	Eugenol	EO (L, Fl, B)	Bandes et al., 1951; Duke, 2016
	D-Camphor	L	
Nausea	D-Camphor	L	Duke, 2016
Flatulence	Eugenol	EO (L, Fl, B)	Duke, 2016
	D-Camphor	L	
Diarrhea	Eugenol	EO (L, Fl, B)	Duke, 2016
	D-Camphor	L	
Fever	Eugenol	EO (L, Fl, B)	Duke, 2016
Colds/Flu	Eugenol	EO (L, Fl, B)	El-Gizawy et al., 2021; Cai et al., 2020; Yu et al., 2019; Li et al., 2017; Li et al., 2016
	Eucalyptol	EO (L)	
	p-Cymene	L	
	α -pinene	L	
Menopause	Lupeol	L	Doyle et al., 2009; Fernandez et al., 2001a; Fernandez et al., 2001b; Flores & Quinlan, 2014
	Abietic acid	L	
Sedative	Eugenol	EO (L, Fl, B)	Cai et al., 2020; Yazaki, 1989
	Myrcene	EO (L, B)	
	Eucalyptol	EO (L)	

EO essential oil, L leaf, Fl flower, B berry

Table 2. Pharmacological Activity and Therapeutic Effects of *P. racemosa*

3.2. *Momordica charantia* L. [CUCURBITACEAE]

Alternative Nomenclature

Common Synonym(s): *Momordica elegans* Salisb., *Momordica muricata* Willd.

Vernacular Names: Cerasee, Bitter Gourd, Balsam Pear, Cunde Amor, Balsamina, Carilla

Main Therapeutic Properties

Hypoglycemic, purgative, anti-inflammatory, astringent, digestive, cathartic, hepatoprotective

Botanical Description

Momordica charantia L. is a climbing perennial herbaceous vine with well-branched, slender stems that are green in color. The leaves are carried singly along the stems and bear solitary yellow flowers with 5 petals. The fruits are ovoid, ellipsoid, or spindle

shaped and covered with longitudinal ridges and warts; when they are young, they are emerald green, and at maturity they turn orange to yellow and the tips split into three revealing yellow pulp and bright red arils.

Distribution and Ecology

M. charantia is widely distributed throughout the tropical and subtropical regions of all continents. Currently, it can be found both naturalized and cultivated in North, Central, and South America, the West Indies, and on several islands in the Pacific Ocean. While it appears to be native to Africa and Australasia, its actual origin has been obscured due to its spread as a food crop.

Ceraceae is best-suited to hot, humid climates and can generally be found growing in coastal areas, along creeks and rivers, forest edges and disturbed sites, at elevations up to 1000 m above sea level (masl). It is intolerant to drought and water stress, preferring areas with 480-4100 mm of rainfall annually. Nevertheless, its rapid growth and maturation allow it to grow under a wide range of conditions given that there is sufficient short-term soil moisture.

Cultivation/Harvesting Practices

M. charantia is typically propagated by seed. Prior to planting in the field, however, the seeds should be rolled in a moistened cloth and kept in the dark for 5 days to increase germination rates. Optimal growth occurs in both tropical and subtropical conditions, under full sun and in a well-draining sandy or clay loam soil that is rich in organic matter. Regular irrigation is also needed (e.g., weekly from the day of sowing) as the crop does not tolerate water-stress or drought. Harvesting of the soursop fruits typically occurs ~60-75 days after seed sowing, when they are still green and immature, whereas the leaves and stems can begin to be harvested 28-42 days after planting and are thereafter available year-round.

Background and Medicinal History

Cultivated forms of *M. charantia* have been cited in Ayurvedic books dating back to 2000 to 200 BCE, while the earliest reference of the plant in China was made in 1370 CE. It was introduced to the New World via the slave trade from Africa. Historically, *M. charantia* was used in West African countries to provide protection against evil spirits, diseases, and madness, as well as for its purification properties. It is said that African slaves brought the plant to the Caribbean islands for its purpose as a health tonic. In 1700s Jamaica, doctors boiled the leaves to “promote the lochia” (tissue, blood, and mucous after childbirth), as well as purgation, cooling, female obstructions (to initiate menstruation), and to stop bleeding.

Present-Day Medicinal Uses

Ethnobotanical surveys in Barbados have found that *M. charantia* is traditionally used for the treatment of hypertension, diabetes, fever, colds/flu, bronchitis, cough, fatigue, constipation, headache, upset stomach, and for cancer prevention. Medico-culturally, it

is regarded for its cleansing, cooling, and tonic properties. Most often, these remedies involve the whole plant (i.e., fruits, leaves, and stem)

Interestingly, recent studies found a more diverse array of medicinal uses and preparations of *M. charantia* in West Africa, which involved both physical and spiritual healing. In Togo, for example, it is used for gastrointestinal problems, chicken pox, measles, skin conditions, malaria, gynecological purposes, fevers, and diabetes; it is also used before the manipulation of sacred objects, and a necklace made from the vine is worn to protect against curses and spells and to aid in obtaining favors. In Ayurveda, different parts of the plant are recommended in the treatment of many diseases, including cholera (seeds), bronchitis (fruits), rheumatism (roots), ulcer (fruits), hepatitis (leaves), diabetes (seeds, fruits), measles (leaves), diarrhea (seeds), and gonorrhea (roots).

Preparation and Posology

Indication	Local Traditional Practices		
	Part(s) Used	Preparation	Administration
Colds/flu	<i>WP</i> ^a	Decoction	Oral – as needed
Cough	<i>WP</i>	Decoction or infusion	Oral – as needed
Fever	<i>L/S</i>	Decoction or chewed	Oral – as needed
Hypertension	<i>WP</i>	Infusion	Oral – weekly or monthly
Diabetes	<i>WP</i>	Decoction	Oral – as needed or monthly
Cancer prevention	<i>L/S</i>	Decoction	Oral
Bronchitis	<i>WP</i>	Decoction or infusion	Oral
Fatigue	<i>WP</i>	Decoction or infusion	Oral
Constipation	<i>L/S</i>	Infusion	Oral – daily
Headache	<i>WP</i>	Infusion	Oral – as needed
Upset stomach	<i>WP</i>	Decoction	Oral – as needed
Cleansing	<i>WP</i>	Decoction or infusion	Monthly
Cooling	<i>WP</i>	Infusion	Oral
Tonic	<i>WP</i>	Decoction or infusion	Oral
Established Caribbean Practices			
Skin conditions	<i>Aer</i>	Crushed	Topical (30 g) – apply to affected area 3 x/day

WP whole plant, *L* leaf, *S* stem, *Aer* Aerial parts

^aWhole plant = fruit, root, leaves, stem

Table 3. Preparation and Methods of Administration of *M. charantia*

Pharmacological Activity

Local Ethnomedicinal Indications	Bioactive Chemical Profile		Supporting Evidence
	Bioactive Compounds	Plant Part(s)	
Hypertension	Charantin	<i>Rt/L/Fr</i>	Desai et al., 2015; Tuan et al., 2017; Lee et al., 2012
	Cucurbitanes	<i>Fr</i>	
Diabetes	Polypeptide-p	<i>S/Fr</i>	Li et al., 2020; Tan et al., 2016; Wu et al., 2014; Aydin et al., 2020
	MCP	<i>Fr</i>	
	Cucurbitacins	<i>Fr</i>	
	Charantin	<i>Rt/L/Fr</i>	
Fever	Ascorbic acid	<i>Fr</i>	Patel et al., 2010; Riski et al., 2020; Duke, 2016
	Magnesium	<i>Fr</i>	
Colds/Flu	MAP30	<i>S/Fr</i>	Puri et al., 2009; Meng et al., 2012; Pongthanapisith et al., 2013; Dalhat et al., 2020
	Momorcharins (α , β , γ)	<i>S</i>	
Bronchitis	Gentisic acid	<i>L</i>	Leelaprakash et al., 2012; Dalhat et al., 2020; Duke, 2016
	Ascorbic acid	<i>Fr</i>	
	Magnesium	<i>Fr</i>	
Cough	Ascorbic acid	<i>Fr</i>	Leelaprakash et al., 2012; Duke, 2016
	Magnesium	<i>Fr</i>	
Fatigue	Charantin	<i>Rt/L/Fr</i>	Poovitha & Parani, 2017; Kwak et al., 2020; Hsiao et al., 2017
Constipation	Inulin	<i>Fr</i>	Kumar & Khanna, 2019; Xu et al., 2019; Duke, 2016
	p-cymene	<i>S</i>	
Headache	Ascorbic acid	<i>Fr</i>	Leelaprakash et al., 2012; Oladela et al., 2009; Patel et al., 2010; Ullah et al., 2012
	Magnesium	<i>Fr</i>	
Upset Stomach	Inulin	<i>Fr</i>	Alam et al., 2009; Bakare et al., 2011; Venkat et al., 2011; Duke, 2016
	Magnesium	<i>Fr</i>	
Cancer prevention	MCL	<i>S</i>	Fang et al., 2012; Manoharan et al., 2014; Pitchakarn et al., 2011; Grossman et al., 2009; Aydin et al., 2020
	Momorcharins (α , β)	<i>S</i>	
	Kuguacin J	<i>L</i>	
	Eleostearic acid	<i>S</i>	
	MAP30	<i>S/Fr</i>	
Cleansing	Ascorbic acid	<i>Fr</i>	Duke, 2016
	Magnesium		

Cooling	Ascorbic acid	Fr	Duke, 2016
	Magnesium		

Rt root, Fr fruit, L leaf, S seeds, MCL Momordica charantia lectin, MCP Momordica charantia polysaccharide, MAP30 Momordica anti-HIV protein

Table 4. Pharmacological Activity and Therapeutic Effects of *M. charantia*

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Damian Cohall, PhD is a Jamaican born pharmacologist with over twenty years of academic experience investigating the health-related benefits of plants in the Caribbean. Dr. Cohall is currently a Senior Lecturer and the Head of the Department of Preclinical and Health Sciences in the Faculty of Medical Sciences at The University of the West Indies, Cave Hill, Barbados. He serves as a member of the Advisory Editorial Board for the West Indian Medical Journal and has published extensively on Barbadian ethnopharmacological practices and pharmacognosy inclusive of a book entitled "Medicinal Plants of Barbados for the Treatment of Communicable and Non-communicable Diseases".