Chapter 1
Ethnobotanical Aspects of Some Traditional Medicinal Plants

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Abstract Ethnobotany (study of usage of plant parts for human health) is considered to be a part of Economic Botany, which emphasizes on the economic utilization of plants for human welfare. Biological diversity is universally recognized as an important part of the world's natural heritage and an essential component for the sustainability of global ecosystems. In the current era, modern allopathic medicines are very fast effective and have over-ridden the traditional herbal remedies. Additionally, the diversity of traditional medicinal plants is facing a continuous decline due to a number of natural and anthropogenic activities including the clear-cutting of forests, conversion of grasslands into cultivated lands, industrialization, overgrazing, soil erosion, desertification, etc. Similarly, overexploitation also poses a severe threat to diversity of medicinal plants and has led to decline severely a number of species. It should be recognized that plant diversity has a commendable importance as a source of pharmaceutically active substances. In this chapter, the medicinal value and usage of various medicinal plants typically used in traditional medicine have been discussed.

Keywords Medicinal plants · Diversity · Active ingredients · Soon Valley · Salt Range

1.1 Introduction

Indigenous knowledge of plants of different areas is as old as human civilization. However, the term "ethnobotany" was first used by an American botanist Johan W. Harshberger in 1896, "to the study of plants used by primitive and aboriginal people." In modern ecological terms ethnobotany was described as "The study of

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direct interactions between human and plant populations" (Plotkin 1991; Heiser 1993). Today ethnobotany is widely accepted as a science of human interactions with plants and related ecosystems. Plants have been used as medicine since ancient times. The use of plants to improve economy is an old tradition of human history.

An ethnobotanical use of plants is more common in many parts of the world especially developing countries like Pakistan due to lack of medical facilities in the far lying areas from cities. For example, 40 medicinally important plant species of 21 families were reported in Kala Chitta Hills (Salt Range) of District Attock which were under common use of indigenous people. Due to increase in population, demands of people increase causing great pressure on the products of the area. The region is very rich in having medicinal plants. To understand the indigenous knowledge of the local people, ethnomedicinal study is very important. This helps a lot for creating awareness among them regarding sustainable natural resource management. Local people, hakims, and medicinal businessmen are very important in this regard (Mahmood et al. 2004).

In Africa, people use different plant extracts for treating trypanosomiasis. Methanolic extracts from 23 plants collected from the Savannah vegetation belt of Nigeria were analyzed in vitro for trypanocidal activity against *Trypanosoma brucei brucei* and *Trypanosoma congolense* at concentrations of 4 mg/ml, 0.4 mg/ml, and 0.04 mg/ml. Extracts of *Khaya senegalensis*, *Piliostigma reticulatum*, *Securidaca longipedunculata*, and *Terminalia avicennioides* were strongly trypanocidal to both organisms, while extracts of *Anchomanes difformis*, *Cassytha* spp., *Lannea kerstingii*, *Parkia clappertoniana*, *Striga* spp., *Adansonia digitata*, and *Prosopis africana* were trypanocidal to either *T. brucei brucei* or *T. congolense*. This provided scientific basis for the use of some plants in the traditional management of trypanosomiasis (Atawodi et al. 2003). Some of the indigenous plants are very important in the diets of post-postpartum women during which time it is claimed that these spices and herbs aid the contraction of the uterus. Spices and herbs are generally known to possess antibacterial and antioxidant properties (Iwu 1989).

1.2 Some Traditional Medicinal Plants

A large number of medicinal plant species have been reported growing in various parts of the world. For example, Leporatti and Lattanzi (1994) studied the ethnobotanical use of 27 medicinal plants species. They reported and discussed their traditional medicinal uses. The inhabitants use the medicinal plants for various purposes and are dependent on surrounding plant resources for their food, shelter, and health. A total of 25 species of herbs belonging to 18 families and their medicinal uses by indigenous people were recorded from the area. Some of these species were used for the treatment of cholera, dyspepsia, fever, herpes, eczema, jaundice, and liver complaints (Qureshi and Khan 2001).

The vegetation of Lawat in the District of Muzaffarabad, Azad Jammu and Kashmir, for ethnobotanical purposes was investigated. He recorded 52 species out of which 3 species were of 2 gymnospermic families while 49 species were of 35 angiospermic families. Most of the plants were used medicinally. The investigation indicated that the medicinal plants were either used singly or with mixtures by local inhabitants. The area under investigation, due to unplanned utilization, had resulted in loss of medicinally important plant species (Dar 2003).

Euphorbiaceae is an important plant family especially recognized for its anticancer components, anti-hepatitis B components, and carcinogenic factors. In the literature of ancient traditional Chinese medicine, 33 species of plants from 17 genera of Euphorbiaceae have been mentioned as medicines. Presently 111 species within 35 genera of medicinal euphorbiaceous plants have been reported. Among them, 17 species were used to treat snakebites. It was observed that most of the species within the Euphorbiaceae family contained toxic components. Only a few species were employed as widespread medicines. Most species were recognized only as local minority tribe medicines (Lai et al. 2005).

Sambucus nigra bush of family Caprifoliaceae is one of the plants which are most commonly used for medicinal and various other purposes by the inhabitants of Catalonia and in many Mediterranean regions. It is a most versatile plant, being used for food and medicine. In addition, almost every part of the plant, including the bark, roots, leaves, flowers, and fruit, has some uses (Valles et al. 2004). Similarly, leaves and roots of *Justicia adhatoda* L. (Acanthaceae) are used for coughs, bronchitis, asthma, and rheumatism. Leaf buds are also used in diabetes and for joints and as antiseptic. Green leaves of *Withania somnifera* (L.) Dunal (Solonaceae) are used to relieve the pain from joints and painful swelling. Roots are used as diuretic and tonic. Juice of the whole plant is useful in rheumatism, whereas seeds have been reported to be used as to coagulate milk (Figs. 1.1 and 1.2).

Whole plant of *Buxus papillosa* is used as diaphoretic, purgative, and antirheumatic. Different species of *Dicliptera* shoots are used as tonic. *Peganum harmala*, a herbal whole plant, is used as an analgesic, aphrodisiac, emmenagogue, hypnotic, and antispasmodic. *Salvia virgata* leaves are applied to tumors and ulcers. *Solanum indicum* roots, leaves, and fruits are used as expectorant, carminative analgesic, and febrifuge. *Solanum surattense* whole plant is used as vasodilator, astringent, and expectorant. *Sophora mollis* or Khumbi seeds are used as anthelmintic (Ahmad et al. 2002; Khan 1951). *Adiantum* species are used for chest complaints, cough, expectorant, increasing lactation, colds, emmenagogue, aiding kidney function, antiparasitic, dandruff, and general cure-all. The fresh or dried leafy fronds are antidandruff, antitussive, astringent, demulcent, depurative, emetic, weakly emmenagogue, emollient, weakly expectorant, febrifuge, galactogogue, laxative, pectoral, refrigerant, stimulant, sudorific, and tonic (Grieve 1984). In Nepal, a paste made from the fronds is applied to the forehead to relieve headaches and to the chest to relieve chest pains. The plant is best used fresh, though it can also be harvested in the summer and dried for later use (Chiej 1984; Launert 1981).

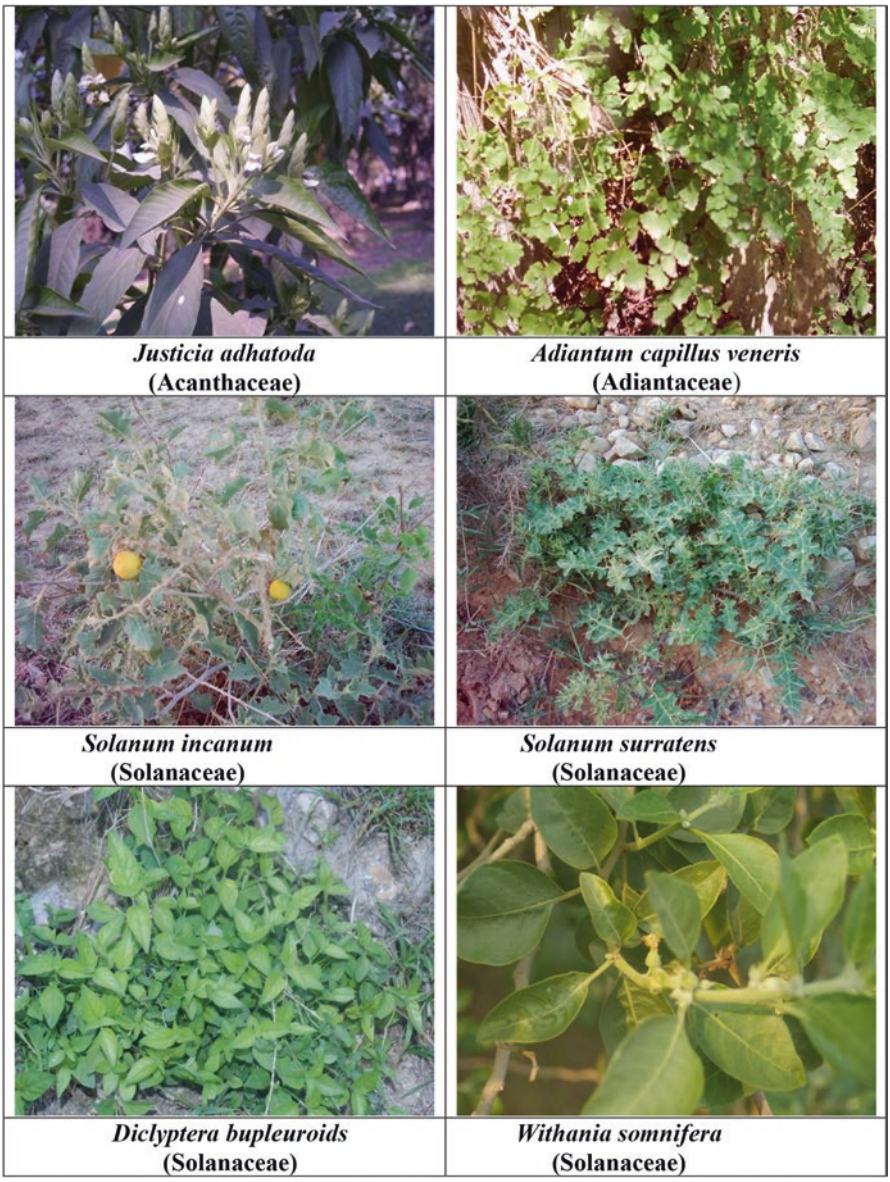

Fig. 1.1 Some important medicinal plants of Acanthaceae, Adiantaceae, and Solanaceae families found commonly growing in Salt Range of Pakistan

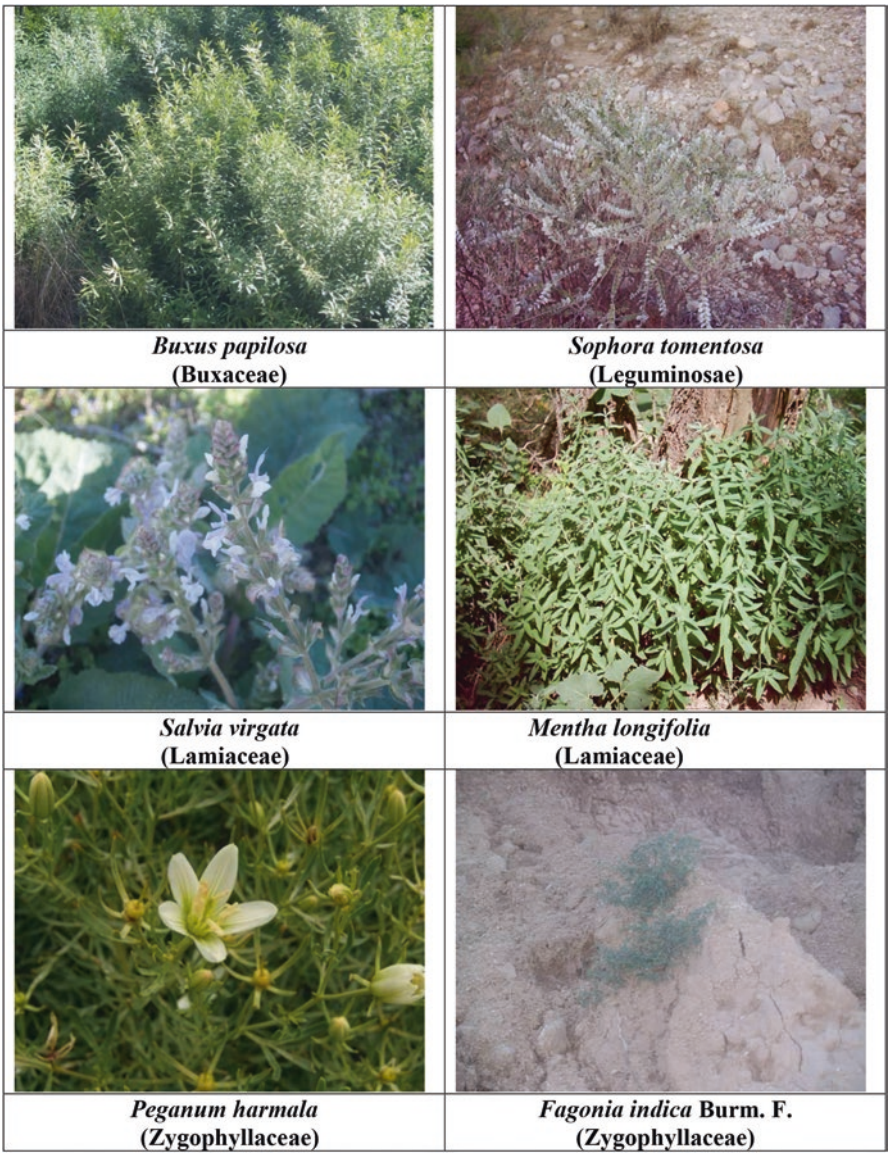

Fig. 1.2 Some important medicinal plants of Buxaceae, Leguminosae, Lamiaceae, and Zygophyllaceae families found commonly growing in Salt Range of Pakistan

1.3 Proximate Composition

Composition described in terms of main classes of substances is called proximate composition, for example, proteins or minerals that first arrived in the process of analysis. In proximate analysis the groups are measured as such, instead of individual proteins or specific minerals (FAO 2001). It mostly includes proteins, fats, minerals, and carbohydrates. Almost all plants contain these substances and are initially analyzed proximately.

Morinda citrifolia is an important medical plant in Southeast Asian countries. It was analyzed proximately and biochemically to make a more modern drug from a traditional product. In order to obtain better understanding of the medicinal characteristics of the *M. citrifolia* a fruit cultivated in Cambodia, fatty acids, proteins, amino acids, and sugars of juices were analyzed (Chunhieng et al. 2005).

Kochhar et al. (2006) analyzed three traditional medicinal plants known for their hypoglycemic action, namely, bitter gourd, fenugreek seeds, and jambu seeds, for proximate composition, available carbohydrates, dietary fibers, and anti-nutritional factors. Protein, fat, ash, crude fiber, carbohydrate, and energy content of these medicinal plants ranged from 4.16% to 25.80%, 0.49% to 6.53%, 2.16 to 9.89%, 1.28 to 10.92%, 58.13 to 90.85%, and 319.11% to 394.46% kcal, respectively. Total soluble sugars, reducing sugars, nonreducing sugars, and starch content varied from 2.03% to 11.76%, 0.78 to 4.43%, 1.03 to 8.0%, and 29.20 to 33.63%, respectively. Dietary fiber constituents like hemicellulose, cellulose, lignin, pectin, and total dietary fiber varied from 8.44% to 34.75%, 1.46 to 8.23%, 0.38 to 5.18%, 0.36 to 2.95%, and 22.4 to 40.38%, respectively. It was found that these plants were a good source of protein, fat, minerals, crude fiber, and energy and a rich source of available carbohydrates and dietary fiber. It was concluded that these hypoglycemic traditional medicinal plants provide various nutrients which are not provided by allopathic medicine, and these plants have no adverse effects. Therefore, the diabetic patients should be encouraged to include these medicinal plants in their daily diet to control blood sugar level.

Ripe fruits of *Dennettia tripetala* were analyzed for proximate composition. *Dennettia tripetala* contained crude protein (15.31%), total carbohydrate (62%), crude fibers (9.84%), crude lipids (3.47%), and moisture (8.0%). It had an energy value of 480.24 g cal·100 g^{-1} of fresh fruit (Okwu and Morah 2004). This justifies the use of *Dennettia tripetala* fruits as food and a drug in herbal medicine in Southeastern Nigeria.

Cymbopogon jwarancusa is a useful plant in diseases of blood, skin, vomiting, abdominal tumors, unconsciousness, and fever (Kirtikar and Basu 1982). This plant was proximately studied (Mahmud et al. 2002) and was found to contain moisture contents, 67.02%; ash contents, 9.52%; carbohydrates, 1.8%; reducing sugar, 1.07%; nitrogen, 0.67%; crude proteins, 5.02%; and crude fiber, 9.50%.

Four medicinal plants belonging to the family Lamiaceae were chemically screened (Edeoga et al. 2006) for their chemical constituents and nutritional value. The medicinal plants contained crude protein (9.19–17.94%), crude fiber (4.88–9.04%), ash

(5.68–6.88%), carbohydrate (66.24–75.87%), crude lipid (3.48–4.90%), and food energy (357.68–373.26 mg/cal). These plants play an important role not only in nutrition but also in traditional medicine and in pharmaceutical industry.

Fagoina arabica is among the widely used medicinal plants all over the world including Pakistan. Generally the plant is located on dry calcareous rocks, distributed in most parts of the Mediterranean region to South Africa, Afghanistan, India, and Pakistan especially Sindh, Punjab, and NWFP (Rizvi et al. 1996). Proximate analysis of this plant revealed that leaves and seeds have maximum moisture content (58.51 ± 0.50) followed by shoots and roots (43.29 ± 0.42, 29.45 ± 0.28, respectively). Ash and protein (1.85 ± 0.12, 0.64 ± 0.01, respectively) increased in different parts in descending order, i.e., roots < shoots < leaves and seeds, whereas fat and fiber contents (1.33 ± 0.05, 56.80 ± 0.23, respectively) decreased in ascending order, i.e., roots>shoots>leaves and seeds (Shad et al. 2002).

Now interest has been developed in wild species for their possible medicinal values in diets. Wild plant species provide minerals, fibers, vitamins, and essential fatty acids and enhance taste and color in diets. In addition, they have antibacterial, hepatoprotective, and anticarcinogenic properties and therefore have medicinal value (Green 1992; Bianco et al. 1998). Yildirim et al. (2001) analyzed eight plant species in Turkey for dry matter, ascorbic acid, nitrogen, and protein which are important nutritionally as well as for medicinal value.

Piliostigma thonningii is a leguminous medicinal plant belonging to the family Caesalpiniacea used for the treatment of dysentery, fever, infections, respiratory ailments, snake bites, hookworm, and skin diseases (Jimoh and Oladiji 2005). Proximate composition of *Piliostigma thonningii* seeds showed that seeds contained moisture contents 6.71%, ash 3.50%, crude proteins 30.33%, crude fibers 35.03%, lipids 1.42%, and carbohydrates 23.00%.

Two rural settled Fulani villages, northeastern Nigeria, were surveyed for the use of wild plants as food or medicine (Lockett et al. 2000). Different parts of commonly used plant species were proximately analyzed for protein, fat, carbohydrate, and mineral contents. Kuka bark (*Adansonia digitata*) given to infants to increase weight gain contained high fat, calcium, copper, iron, and zinc contents. Cediya *(Ficus thonningii*), dorowa (*Parkia biglobosa*), and zogale (*Moringa oleifera*) were found to be the good sources of protein and fat and excellent sources of calcium and iron or copper and zinc. Fruits, leaves, and nuts of aduwa (*Balanites aegyptiaca*) were widely used during the dry season and drought. Edible wild species available during the wet season generally were inferior in energy and mineral content as compared to dry season plants. Fruits commonly eaten by children were poor sources of protein and minerals but rich in carbohydrate and fibers. Shiwaka leaves (*Veronia colorate*) that were mostly consumed by pregnant women to increase breast milk production and to expel intestinal worms contained high-fiber contents.

In Nigeria four medicinal plants belonging to the family Lamiaceae were chemically screened and found to contain high percentage of phytochemicals. The medicinal plants investigated were *Hyptis suaveolens* and three putative hybrids of *Ocimum gratissimum* (Hybrid A, B, and C). The plants contained crude protein (9.19–17.94%), crude fiber (4.88–9.04%), ash (5.68–6.88%), carbohydrate (66.24–75.87%), crude

lipid (3.48–4.90%), and food energy (357.68–373.26 mg/cal). This showed the significance of these plants not only in traditional medicine but also in food and in pharmaceutical industries (Edeoga et al. 2006).

Carica papaya belonging to the family Caricaceae is an important and common medicinal plant in tropical Africa. Proximate analysis of the unripe pulp of *Carica papaya* was analyzed for the presence of different phytochemicals and minerals (Oloyede 2005). It showed that the pulp contained starch (43.28%), sugars (15.15%), crude protein (13.63%), crude fat (1.29%), moisture (10.65%), and fiber contents up to 1.88%. These results indicated that the pulp of mature unripe *Carica papaya* contained nutrients and mineral elements useful in nutrition. The presence of some phytochemicals like saponins and cardenolides explained the astringent action of the plant encountered in the numerous therapeutic uses.

Arubi (2003) analyzed papaya kernel flour for proximate composition and functional properties. The flour was high in protein (32.4%) but moderate in available carbohydrates (49.9%) and low in moisture (7.5%) contents. The total minerals and fiber contents were 5.3% and 4.2%, respectively. Oil and water absorption capacities of the flour sample were high. The flour had very good foaming and emulsifying properties. These results suggested that papaya kernel flour can be used in a number of food formulations.

The underground caudex of the cycad, *Stangeria eriopus*, is used extensively by several communities in South Africa, mainly as an emetic. It was found that only in the month of July during 1992, 3410 plants were sold, which threatened the remaining plant populations. Proximate analysis of the caudex material gives high carbohydrate content with only small percentages of fat, protein, fiber, and ash (Osborne et al. 1994).

Hassan and Umar (2006) studied the nutritive value of *Momordica balsamina* L. leaves by analyzing their proximate composition, amino acids, and mineral constituents. The results showed that the plant leaves had high moisture contents (71.00 ± 0.95% fresh weights). The concentration of estimated crude protein and available carbohydrates on dry weight (DW) basis was 11.29 ± 0.07% and 39.05 ± 2.01%, respectively. The leaves also have high mineral (18.00 ± 0.56% DW) and crude fiber (29.00 ± 1.23% DW) contents, while crude lipid contents (2.66 ± 0.13% DW) and energy value (191.16 kcal/100 g DW) were low. The results indicated that the *Momordica balsamina* leaves could be a good supplement for mineral, protein, carbohydrate, and fiber contents.

Wild edible plants form an important part of traditional diets in the Himalaya. In the Sikkim Himalaya, 190 species were screened as edible species, out of which nearly 47 species came to the market. Twenty-seven plant species were analyzed proximately for their nutritive values, 22 were edible for their fruits and 5 for leaves and shoots. Among different plant parts, generally higher nutrient concentration was recorded for leaves, followed by new shoots and fruits (Sundriyal and Sundriyal 2004). For different species the crude fiber contents ranged between 2.15% and 39.90%, total soluble salts between 4.66% and 21.00%, and vitamin C contents from 6 to 286 mg/100 g. The fat contents were determined high in the fruits of

Castanopsis hystrix, *Machilus edulis*, and *Cinnamomum* species, while the protein contents were highest in *Hippophae rhamnoides*, *Cucumis melo*, and *Elaeagnus latifolia*. The total carbohydrate contents ranged from 32% to 88% in the fruits of various wild plants, whereas the reducing sugar ranged from 1.25% to 12.42% and total sugar from 2.10% to 25.09% and the lignin contents varied from 9.05% to 39.51%, the hemicellulose between 25.63% and 55.71%, and cellulose contents from 9.57% to 33.19% in different species. It was suggested that a few wild edible species were needed to be grown for commercial cultivation and included in the traditional agro-forestry systems, which will reduce pressure on them in natural forest stands as well as producing economic benefits for poor farmers.

1.4 Minerals

The attention toward the inorganic constituents of medicinal plants was drawn by Hakim Abdul Hameed, President of Hamdard National Foundation, India, who is the originator of the discipline "Elementology" (Arora et al. 1984).

Health depends upon the organized state of elements in the body, and their imbalance causes disease (Golden 1988), and restoration of balance by drugs can cure diseases.

Medicinal plants show therapeutic effects for the treatment of different diseases due to the presence of certain chemical compounds in these plants. These are mostly organic compounds which have biological activities, but none of these act independently and they cannot perform the functions of the medicinal plant as a whole (Mutaftchiev 2003).

Analyses have showed that medicinal plants are rich in many trace elements, and it was suggested that this was an important factor in the curative effect of these plants (Olabanji et al. 1997; Pereira and Felcman 1998). The trace elements can be found in free-states or organically bound in a complex. It is a well-established fact that different states and forms can have different functions in its physiological activities such as biotoxicity and percent absorption in the body (Svendsen and Lund 2000). Trace elements coexist with various organic compounds in medicinal plants (Remington 1995), and mostly they are bound to organic compounds. So the concentration of the free trace elements will be very low.

Medicinal properties of most of the medicinal plants are attributed mainly due to their cultivation in different parts of the world (Rajput et al. 1996), and the active constituents, especially inorganic elements present in plants, are in very variable quantities (Gauch 1972) if grown in different environmental conditions and different types of varieties used for cultivation. It is very much clear now that inorganic trace elements are very active in very small concentrations, and the analysis of different parts of both plants and decoction has shown the presence of many essential and important elements such as Ca, Mg, Zn, Fe, Co, Mn, etc. Zn is very effective in killing virus (Randal 1984).

Sahito et al. (2001) investigated two varieties of medicinal herb *Catharanthus roseus* for elemental composition as Ca, Na, K, Mg, Zn, Fe, Cu, Co, Mn, Ni, Cd, Pb, Ba, and Al. The level of essential elements such as Zn, Fe, Mn, and Cu was present in considerable amount. In decoction the level of essential elements was high as compared to toxic elements.

Most of the medicinal plants qualify as nonprescription drugs, and some of them are taken in low doses as food drugs in these days (Obiajunwa et al. 2002), for example, Se, Zn, vitamin E, and other antioxidants of plant origin are proving to be reliable weapons in the effort against premature aging and the postponement of degenerative diseases. There are at least 50 elements which are vital for the well-being of humans (Tolonen 1990). Now the people are very much interested in trace elements in the area of medical science.

Obiajunwa et al. (2002) investigated different major and minor elements in different plants. Fourteen different elements, namely, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Se, Br, Rb, and Sr were detected in varied amounts in different plants. The concentrations of Ca and K were the highest, whereas Br and Se were the least. All the essential elements were present in required dose, but some plants such as *C. procera*, *A. indica*, and *A. wilkesiana* showed toxicity due to their high Cr level.

The high concentration of Ca is very important as Ca enhances the qualities of bones and teeth and also of neuromuscular systemic and cardiac functions. Iron is another important element present in all the specimens which plays a role in oxygen and electron transport in human beings. The high amount of Fe and Ca in *C. alata* showed that it could be especially useful in the treatment of constipation in nursing and pregnant mothers at 5 g/dose, as its main medicinal activity is as a mild laxative. *E. hirta*, *A. melegueta*, *M. indica*, and *G. kola* contained high concentration of Zn and could be used in cases of Zn deficiency which includes impairment in healing, taste, and growth (Obiajunwa et al. 2002). In addition to identifying the active secondary metabolites of these medicinal plants, the knowledge of their elemental composition is very important in determining their toxicity or safety for use.

More than 25 naturally occurring elements perform essential functions in the human body. Some of them such as zinc, copper, selenium, cobalt, chromium, molybdenum, manganese, and iodine are required in small amounts, and each comprises less than 0.01% of the body weight, and they are called as essential trace elements. They work in a similar way in the body. Most of them are at the active site of enzymes or of physiologically active substances of the body. Dietary deficiency of these elements causes various problems, which are consistent with the decreased activity of these active substances (Wada and Yanagisawa 1996).

Zinc is one of the most important trace elements in the body as it performs various biological activities. It is an essential catalytic component for more than 200 enzymes and also acts as a structural component of many proteins, hormones, neuropeptides, hormone receptors, and most likely polynucleotide (Fabris and Mocchegiani 1995). Due to its role in cell division, differentiation, programmed cell death, gene transcription, biomembrane functioning, and obviously many enzymatic activities, zinc is considered a most important element in the accurate working of an organism, from the very first embryonic stages to the last periods of life

(Fabris and Mocchegiani 1995). The zinc supplementation is efficacious in most of the problems. It is said to be a therapeutic support instead of a simple dietary supplement. The relevance of zinc to many age-associated diseases and the aging itself of the major homeostatic mechanisms of the body, i.e., the nervous, neuroendocrine, and immune systems, places zinc in an essential position in the economy of the aging organism.

Rajurkar and Damame (1998) studied elemental composition of some Ayurvedic medicinal plants used for healing urinary tract disorders. Fourteen elements were estimated in different plants: among these Cu, Cr, Co, and Cd were found to be present at the trace level; Mn, Pb, Zn, Ni, Na, Fe, and Hg at minor level; and K, Ca, and Cl at major level. The differences in the concentration of the elements are attributed to soil composition and the climate in which the plant grows. It was found that these elements play an important role in treatment of urinary tract disorders.

Some inorganic trace elements such as V, Zn, Cr, Cu, Fe, K, Na, and Ni play an important role in maintaining normoglycemia by activating the beta-cells of the pancreas. Leaves of four traditional medicinal *plants* (*Murraya koenigii*, *Mentha piperitae*, *Ocimum sanctum*, and *Aegle marmelos*) widely used in the treatment of diabetes and related metabolic disorders were analyzed for different inorganic elements. The levels of Cu, Ni, Zn, K, and Na were found to be in trace amounts, and Fe, Cr, and V levels were found in minor levels (Narendhirakannan et al. 2005).

According to Anke (1986) 7 quantitative elements and perhaps 18 trace elements are of vital importance for the animals. Their metabolism is antagonistically or synergistically influenced by the inorganic and organic constituents of the food of different kinds. More than 30 elements (Cu, Zn, Mg, Mn, Cr, V, and so on) are involved in the treatment in the process of arteriosclerosis.

Singh and Garg (1997) analyzed specific plant parts of several plants (fruits, leaves, or roots) often used as medicines in the Indian Ayurvedic system for 20 elements (As, Ba, Br, Ca, Cl, Co, Cr, Cu, Fe, K, Mn, Mo, Na, P, Rb, Sb, Sc, Se, Sr, and Zn). Most of the medicinal herbs were found to be rich in one or more of the elements under study.

Dennettia tripetala or pepper fruit plant is a well-known Nigerian spicy medicinal plant. *Dennettia tripetala*, besides protein, carbohydrate, fibers, and lipids, also contains important mineral contents as calcium (1.80%), phosphorus (0.33%), potassium (2.50%), and magnesium (0.42%). Trace elements included Fe, Cu, Zn, and Cd; however, Cr was not detected. This justifies the use of *Dennettia tripetala* fruits as food and a drug in herbal medicine in Southeastern Nigeria (Donatus and Morah 2004).

Mineral analysis of *Piliostigma thonningii* showed that seeds were good source of antioxidant micronutrients such as Fe, Ca, Se, Zn, and Mn. So it could serve as a cheap source of antioxidant micronutrients supplements in both man and animal.

The level of iron among all minerals analyzed was found to be the highest (782 ppm). This might be of nutritional importance especially in the part of the world where anemia and iron deficiency is more common (Jimoh and Oladiji 2005). *P. thonningii* seeds are also good sources of calcium (43.11 ppm), while zinc (0.016 ppm), manganese (1.00 ppm), and phosphorus (0.02 ppm) levels were quite

low when compared with iron and calcium but comparable with values for some legumes (Elegbede 1998). Iron, selenium, zinc, and manganese are antioxidant micronutrients (Talwar et al. 1989), and their presence could thus boost the immune system.

Fagoina arabica is among the widely used medicinal plants in Pakistan. Its mineral composition showed that Zn and Na were maximum in roots and minimum in leaves and seeds. Concentrations of Fe, P, K, and Ca decreased in order of leaves, seeds, shoots, and then roots. *Fagonia arabica* contained Ca, Na, P, Cu, Fe, Mn, and Zn. Zn plays an important role as an antioxidant in animals (Bray and Betteger 1990) as well as in plant membranes (Cakmak and Marschner 1988). *Fagonia arabica* contains lower amounts of heavy metals. The possible reason for low concentrations of heavy metal could be due to the fact that this herb is found mostly in desert and dry calcareous rocks where industrial pollutions are not found, which might have resulted in least amount of heavy metal. However, the macro elements (P, K, Na, Ca) were found to be maximum. Phosphorus is mainly involved in RNA, DNA sugar-phosphate backbone, in the process of energy transfer, and it is the inorganic phosphate that appears as an intermediate product during photosynthesis and respiration pathways of metabolism (Shad et al. 2002).

Fagonia arabica contains a fair amount of K and Na. Due to this reason, it is mostly used in diseases like diarrhea, stomatitis, and deobstruent (Dey et al. 1980) where mostly fluid losses take place (Whitney and Hamilton 1984).

Cu, Zn, Mn, and Fe are considered as trace elements due to their relatively minute quantity that is essential to the body. Copper is important for red blood cell formation, mitochondria function, and a component of ribonucleic acid, whereas Zn, Mn, and Fe are necessary for the development of bones and connective tissues (Nielsen 1987).

Unlike other compounds, living organisms cannot synthesize mineral elements. Only small fraction of the Ca, Mg, and P and most of the Na, K, and Cl are present as electrolytes in the body fluids and soft tissues. Electrolytes present in blood or cerebrospinal fluid maintain acid-base and water balance and adjust osmotic pressure. They regulate membrane permeability and exert characteristic effects on the excitability of muscles and nerves (Nielsen 1987; Bukhari et al. 1987).

The distribution of the elements in various genera and species of plants will be highlighted in the knowledge of the distribution of certain valuable trace elements and their availability from medicinal plants. The uptake of mineral constituents depends on many factors such as the amount of mineral elements present in soil, their availability, moisture contents of soil, and the botanical factor. The variation in mineral composition was observed in different varieties of the same species (Sahito et al. 2001).

1.5 Bioactive Substances

Medicinal plants are considered very important for the health of individuals and communities. These plants mostly display a wide range of biological and pharmacological activities such as anti-inflammatory, antibacterial, and antifungal properties (Okwu and Ekeke 2003; Okogun 1985). The medicinal value of such plants is due to the presence of some chemical substances which create or enhance a definite physiological function in the human body. Phytochemicals perform many ecological and physiological functions and are widely distributed in plant kingdom. Medicinal plants can synthesize and accumulate a great variety of phytochemicals including alkaloids, flavonoids, tannins, cyanogenic glycosides, phenolic compounds, and saponins (Pandey 1980; Edeoga et al. 2005; Okwu 2004). Phytochemicals are present in different plants and are used as important components of both human and animal diets. Diets containing an abundance of fruits and vegetables are protective against a variety of diseases, particularly cardiovascular diseases (Uruquiaga and Leighton 2000). Herbs and spices are harmless sources for obtaining natural antioxidants (Okwu 2004; Kim et al. 1994). Most of these are potent bioactive compounds found in different parts of medicinal plant that can be used for therapeutic purpose or which are precursors for the synthesis of useful drugs (Sofowara 1993). The active principles differ from plant to plant due to their biodiversity, and they produce a definite physiological action on the human body (Edeoga et al. 2006).

Leaves and stems of most of the plants were found rich in alkaloids, flavonoids, tannins, and phenolic compounds. They had already been examined to show medicinal activity as well as exhibiting physiological activity (Sofowara 1993). Natural products have been an important source of drugs for centuries, and about half of the pharmaceutical market presently depends on natural products (Clark 1996).

Ten medicinally important plants belonging to different families were analyzed and compared for alkaloids, tannins, saponins, terpenoid, flavonoids, and phenolics. The medicinal plants investigated were *Cleome rutidosperma*, *Emilia coccinea*, *Euphorbia heterophylla*, *Physalis angulata*, *Richardia brasiliensis*, *Scoparia dulcis*, *Sida acuta*, *Spigelia anthelmia*, *Stachytarpheta cayennensis*, and *Tridax procumbens*. All the plants were found to contain alkaloids, tannins, and flavonoids except for the absence of tannins in *S. acuta* and flavonoids in *S. cayennensis*, respectively. These plants were found very important in traditional medicine (Edeoga et al. 2005).

Phenolic compounds are widely distributed in the plant kingdom, and the presence of phenols is considered to be potentially toxic to the growth and development of pathogens (Singh and Sawhney 1988). Phenolic compounds act as electron donors and are readily oxidized to form phenolate ion or quinine which is an electron acceptor. Protonated phenol is used as a cleaning agent (Uruquiaga and

Leighton 2000) and acts as anti-inflammatory, anticlotting, antioxidant, immune enhancer, and hormone modulator agents. Phenols have been the subjects of extensive research as disease preventives (Duke 1992). Phenols have been shown to have the ability to block specific enzymes that cause inflammation. They also modify the prostaglandin synthesis pathways and thereby protect platelets from clumping.

Phytochemicals show a wide range of biological effects due to their antioxidant properties. Several types of polyphenols (phenolic acid and flavonoids) show anticarcinogenic and antimutagenic effects (Uruquiaga and Leighton 2000). Polyphenols are considered to interfere several steps in the development of malignant tumors, inactivating carcinogens and inhibiting the expression of mutagens. Several studies have shown that in addition to their antioxidant protective effect, polyphenols, particularly flavonoids, also inhibit the initiation, promotion, and progression of tumors (Okwu 2004; Uruquiaga and Leighton 2000). Recently plant flavonoids have attracted attention as potentially important dietary cancer chemo-protective agents (Okwu and Okwu 2004). In addition, the possible antitumor action of certain flavonoids has also generated interest (Kandaswami et al. 1991). Moreover, naturally occurring phytochemicals are potential anti-allergic, anticarcinogenic, antiviral, and antioxidant agents (Okwu 2004; Uruquiaga and Leighton 2000). Flavonoids represent the most common and widely distributed groups of plant phenolics that are potent water-soluble super antioxidants and free radical scavengers which prevent oxidative cell damage, have strong anticancer activity, and protect against all stages of carcinogenesis (Okwu 2004). Flavonoids in intestinal tract lower the risk of heart disease (Cook and Samman 1996). Most of these effects of flavonoids have been linked to their known functions as strong antioxidants, free radical scavengers, and metal chelators (Torel et al. 1986; Nakayama et al. 1993). Flavonoids are mostly 15-carbon compounds and are distributed throughout the plant kingdom (Harborne 1973). Some isoflavones act as allelochemicals widely used in insecticides. They are also important in disease resistance (Salisbury and Ross 1992).

Some other biological functions of flavonoids include protection against allergies, inflammation, free radicals, platelet aggregation, microbes, ulcers, hepatoxins, viruses, and tumors (Okwu 2004; Okwu and Omodamiro 2005).

The presence of phenolic compounds in certain plants makes them very good antimicrobial and antibacterial agent in different infections. This is the reason that *B. pinnatum*, with higher phenolic compounds, is effective in the treatment of typhoid fever and other bacterial infections, particularly those caused by *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Klebsiella aerogenes*, *Klebsiella pneumoniae*, and *Salmonella typhi* (Ofokansi et al. 2005). These results supported the use of *B. pinnatum* in treating the placenta and navel of a newborn baby, which not only heals fast but also prevents the formation of infections (Okwu 2001, 2003).

Alkaloids were also detected in these plants. Alkaloids and their synthetic derivatives are used as basic medicinal agents for their analgesic, antispasmodic, and bactericidal effects (Stary 1998). They show marked physiological activity when given to animals (Okwu and Okwu 2004).

The phytochemical analyses of *Piliostigma thonningii* seeds showed that seeds contain saponins, flavonoids, phenolics, glycosides, as well as cardiac glycosides (Jimoh and Oladiji 2005). Some of these chemical compounds have been reported to have inhibitory effects on some gram-negative bacteria such as *Escherichia coli* and *Bacillus subtilis* among others. They also have prominent effects on animal systems and microbial cells (Liu et al. 1990; Oyagade et al. 1999). The presence of these chemical compounds therefore suggests the pharmacological activities of *P. thonningii*.

Four medicinal plants of family Lamiaceae were analyzed chemically for certain phytochemical constituents including alkaloids, tannins, saponins, flavonoids, and phenols. The plants investigated were *Hyptis suaveolens* and three putative hybrids of *Ocimum gratissimum*. All the plants contain high percentage yield of crude alkaloids and flavonoids ranging from 10.44–14.32% to 9.28–12.54%, respectively. Tannins and phenols were present in all plants; however, saponins were absent in these plants. This gives significance of these plants in traditional medicine and in the pharmaceutical industries (Edeoga et al. 2006).

Two Nigerian medicinal plants (*Garcinia kola* Heckel and *Aframomum melegueta*) were analyzed for their phytochemicals (Okwu 2005). These plants were found to contain bioactive constituents as flavonoids (5.76–1.98 mg/100 g), phenols (0.09–0.11 mg/100 g), saponins (1.24–11.48 mg/100 g), and tannins (0.26–0.38 mg/100 g). These constituents are considered responsible for the health-related properties of these plants, which are based on their antioxidant, anticancer, antitumor, antiviral, anti-inflammatory, and anti-allergic activities. These facts justify the popular use of *G. kola* and *A. melegueta* in herbal medicine in Nigeria.

1.6 Conclusion

According to the World Health Organization (WHO), more than 80% of the world's population relies on traditional herbal medicine for their primary health-care needs. These traditional systems are culturally and psychologically more tolerable in most of the societies as compared to western allopathic medicines. In addition, being the natural plant products, they are considered to be the safest way of treating diseases with least side effects on human health as compared to allopathic or homeopathic medicines. Medicinal plants not only serve as important source of raw materials for the manufacture of traditional medicines but also used for the preparation of a number of modern allopathic medicines. The use of herbal medicines is increasing day by day, and efforts are underway to examine the medicinal plant resources and their active ingredients. However, the research in medicinal plants requires a considerable interaction of researchers with indigenous communities. In addition, successful research must involve peoples from other disciplines such as ethnobotanists, natural product chemists, pharmacologists, taxonomists, traditional healers, and/or user communities, and if useful compounds are isolated that have need of development, then synthetic chemists are compulsory.

This chapter on medicinal flora of the Soon Valley in Salt Range shows that more than 98 angiosperms of 45 families are traditionally locally used as healing agents. However, a large number of plant species belonging to different plant groups still need a thorough pharmacognostic assessment. Local people collect and sell a large number of species of plants to merchants in the market or to larger pharmaceutical trading houses. This, however, is not done on a scientific basis, and species may be mixed, or not collected at the time of maximum potency because the synthesis of various nutritional and medicinal components varies considerably during different seasons and at different localities. Different plants are used for different medicinal purposes throughout the country. During the last quarter century, environmental and cultural changes and market-based economics have seriously influenced all aspects of traditional medicine systems by affecting environment and resources of traditional medicine. Over harvesting of medicinal plants and animal species has resulted in resource degradation, loss of biodiversity, and the loss of indigenous and traditional medicinal knowledge. Such extensive uses are common threats to most of the plant species.

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