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1.1. ENVIRONMENT

Environment has been a source of medicinal agents for thousands of years and the use of medicinal plants, especially in conventional medicine, is currently well recognized and established (Kafaru, 1994). Environment has been a foundation of curative agents ever since times immemorial. It is evident that the plant kingdom harbours an infinite resource of vital ingredients that are very useful in the management of countless diseases. Moreover, the active components of herbal remedies have the advantage of being combined by way of many other substances. Conversely, these complementary components give the plant an entire safety in addition to preparation of herbal forms (Shariff, 2001). Plants are important source for the balance of nature. They are the key to life on earth as they directly supply 90% of human calorie intake, and 80% of the protein intake, the remainder been derived from animal products, although these animals also derive their nutrition from plants. Of the three thousand plant species which have been used as food by man, the world now depends mainly on around twenty crop species for the majority of its calories, with 50% being contributed by eight species of cereals. Minerals and vitamins are supplied by a further thirty species of fruits and vegetables. Most important of the staple foods are the cereals, particularly wheat and rice. More than one third of all the cultivated land used to produce these two crops. From thousands of years the plant lives have been utilized as medicines (Samuelsson, 2004). In the beginning, these medicines took the form of crude drugs like tinctures, teas, poultices, powders in addition to herbal formulations (Balick and Cox, 2005). Many Medicinal plants were added daily in Herbal Pharmacopeia as a potential source of drugs.

1.2. ENVIRONMENTAL DISASTER

Environmental disaster is defined as a result caused by human activity that consequential in a critical situation on the environment (Diamond, 2005). It can also affect agriculture, biodiversity, the economy and human health. The causes of disaster include pollution, depletion of natural resources and scarcity of pure water.


1.2.1. Natural Disasters

Natural disasters can be measured with the atmospheric, geologic and hydrologic origins. These comprise of earthquakes, volcanic eruptions, landslides, tsunamis, floods and drought. They are capable of having speedy or sluggish inception, in addition to serious health, social as well as economic consequences. Throughout the history of two decades, natural disasters have killed millions of people, unfavourably distressing the lives of an amount of one billion supplementary people and consequential in substantial economic smash up. The gradual increase of lifeless bodies in disaster-affected areas can heighten the expectations of disease outbreaks (De ville de, 2004). Environment dreadful conditions engage in recreating a crucial role in triggering several disasters. Countries with severe deforestation, erosion, over cultivation and over-grazing of trivial lands are smack hardest by catastrophes. For example, deforestation results in an augmented concentration of surface runoff in addition to flooding, and destabilised slopes results in distressing landslides (Datt and Geib, 1997). The occurrence of natural disasters such as storms and floods are rising day by day. A number of these phenomenon chiefly floods, are being triggered by human need for the environment and disturbance of previously stable ecosystems.

The susceptibility to natural disasters is furthermore increasing due to rising population and poorly planned urban growth. The quantity and compactness of individuals living in cities are mainly encircled by earthquakes as well as tropical cyclone zones which rose drastically in the history of two decades. This expansion has mainly been random and unrepressed. Physical transportation has extended rapidly and has prompt sustainable production from the point of view of justifying events like floods and earthquakes. Reduced planning decision have led to the establishment of potentially harmful facilities, such as nuclear power plants, chemical factories along with major dams, in earthquake prone zones and thickly populated areas. In contemporary academia, disasters are seen as the consequence of improperly managed risk (Quarantelli, 1998). When a disaster hits the developing country, it suffers the greater costs- more than 95% of all death was caused by disasters which occur in developing countries and loss due to natural disasters are 20 times greater in developing countries as comparable to industrialized countries.

Disasters associated with natural events might have an effect on the transmission of pre-existing infectious diseases such as during the short term, an increased amount of diarrheal diseases, acute respiratory infections, and dermatitis will occur and during the medium term, intense rainfalls may possibly have an effect on the spread of vector-born
diseases, for example, as of residual water that might add to an explosive rise in mosquitoes will lead to increase the malarial infection.

Earthquakes may also cause a huge add up to injuries, whereas for the most part are life-threatening. Tsunamis are disastrous tidal waves caused by earthquakes on the ocean floor. Waves can pass through more than a few hundred kilometres per hour and be capable of as much as 10 meters high after they reach shore. Damage on shore can be widespread. Volcanoes cause serious problems, yet they are often overlooked because of long periods of inactivity. Eruptions are preceded by a phase of volcanic activity, a number of issues such as ash fall, lethal gases, lava flow, and projectiles, are alarming things for health significance. Falling ash affects a lot to transportation, communications, water, treatment plants, and reservoirs.

1.2.2. Climate Disasters

Climate disasters comprise of seasonal floods, hurricanes, and typhoons. Seasonal floods cause improved incidence of diarrheal diseases, respiratory infections, dermatitis, and snake bites. The danger of contamination of water supplies depends on the condition of the community’s water supply previous to the disaster (De ville de et al., 2006).

1.3. INFECTIONOUS DISEASES

Even though the general risk of communicable disease occurrence is subsidiary than frequently evident, the danger of spread of definite endemic in addition to epidemic-prone diseases can enhance the natural disasters such as:

1.3.1. Water-Borne-Disease

Water-Borne-Disease i.e. diarrhoeal disease is caused by the contamination of drinking-water and the threat of diarrhoeal disease is higher in developing countries than in developed countries (Ahern, 2005). Hepatitis A and E are furthermore transmitting via the faecal–oral route, in organization among the way to safe water along with sanitation. Hepatitis A is endemic in the developing countries and also caused in the children which are bare and grow immunity at an early age. In endemic areas, hepatitis E outbreaks often follow heavy rains in addition to floods; it is usually a mild, self-limited illness (Aggarwal and Krawczynski, 2000). Leptospirosis is a zoonotic bacterial disease so as to transmit throughout contact of the skin along with mucous membranes by water, damp vegetation, or mud contaminated with rodent urine (Yang, 2005).
1.3.2. Diseases Associated with Crowding

Diseases associated with crowding i.e. Measles with the danger of spread in the disaster-affected population is dependent relative on the baseline vaccination reporting rates among the affected population, and is scrupulous along with children aged less than 15 years (Marin, 2006). Meningitis cause by *Neisseria meningitidis* is transmitting from person to person, predominantly in situation of crowding. Acute respiratory infections (ARI) are a foremost source of morbidity as well as mortality along with displaced populations, mainly in children aged less than 5 years. Risk factor includes crowding, exposure to indoor cooking in addition to poor nutrition (Campanella, 1999).

1.3.3. Vector Borne Disease

Natural disasters, mainly meteorological actions such as cyclones, hurricanes and flooding, are able to influence vector breeding sites in addition to vector-borne disease transmission. Though primary flooding may perhaps wash away existing mosquito breeding sites, standing-water cause by intense rainfall or else runoff of river be capable of generating new breeding sites. This can result in an enhance of the vector population along with prospective for disease transmission, depending on the restricted mosquito vector species and it’s a preferred habitat (Lifson, 1996). Vector Borne Disease i.e. Malaria outbreaks in the wake of flooding and a well-known phenomena which is a mosquito-borne infectious disease of humans and other animals caused by eukaryotic protists of the genus *Plasmodium*. Dengue spread is prejudiced by meteorological conditions together with rainfall and humidity furthermore often exhibit tough seasonality. Though, transmission is not directly associated with flooding but might coincide by periods of elevated transmission risk by improved availability of vector breeding sites i.e. by mainly artificial containers or caused by disturbance of water supply in addition to hard waste disposal services.

1.3.4. Diseases Associated with Natural Disasters

Other diseases associated with natural disasters i.e. Tetanus is not transmitted from person to person, but is caused by a toxin released by the anaerobic tetanus bacillus *Clostridium tetani*. Contaminated wounds, particularly in populations where routine vaccination coverage levels are low, are associated with morbidity and mortality from tetanus. Coccidiomycosis is not transmitted from person to person, but is caused by the fungus *Coccidioides immitis*, which is found in soil in certain semi-arid areas of North and South America (Schneider et al., 1997).
1.4. MALARIA

Malaria is the foremost parasitic disease in the world, mainly in India. It is generally ubiquitous in the midst of the insect-borne diseases. It is conscientious for 500 million new cases and 2 to 3 millions deaths every year, on the whole amongst children under five years as well as pregnant women. It is a traditional example of a disease that affects the efficiency of individuals, families as well as the entire society. It is widespread in the poorer, moreover, less-developed countries of the world (Ekthawatchai et al., 1999). The erstwhile hard strike tropical areas comprise East Asia, China with India. It was estimated that as a lot of 40% of India’s malaria cases is caused by *Plasmodium falciparum* (Kumar, 1994). This disease results from the multiplication of Plasmodium parasites within red blood cells, which cause symptoms that includes fever as well as headache, in several cases progressing to coma or death. *P. falciparum* is the generally well-known etiological agent intended for human malaria have turn out to be gradually more opposed to standard antimalarials e.g. chloroquine and antifolates. The initial antimalarial drug is quinine which is isolated from the bark of *Cinchona* species (Rubiaceae) in the year 1820. It is the solitary of the oldest and for the most part important antimalarial drugs, and is still dominantly used today (Beckmann, 1958). In 1940, an additional antimalarial drug chloroquine was synthesized along with until recently; this was the one of the significant drug used for the treatment of malaria (Bharel et al., 1996).

More than 100 diverse species of *Plasmodium* are present and day by day new species are emerging in nature. They generate malaria in many types of animals with birds, as well as in humans. The five species of malaria i.e. *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae* and *Plasmodium knowlesi* can cause disease and be transmitted by humans (Sutherland et al., 2010). The deadliest among all the species of the parasite be *Plasmodium falciparum*, a species on the whole probable be transmitted by means of the mosquito *Anopheles gambiae*. *P. falciparum* caused the severe disease, whereas *P. vivax, P. ovale, P. malariae* generally cause a little less infection which is milder and rarely fatal. The fifth species i.e. *P. knowlesi* is a zoonosis that causes malaria in macaques but it may also infect humans (Fong et al., 1971).

Malaria, a parasitic disease, significantly starts the infection from one out of five species of *Plasmodium* protozoa. The life cycle of malaria parasite has a multifaceted as well as multistage, happening within two living beings, the vector mosquitoes along with the vertebrate hosts. The endurance with enlargement of the parasite inside the invertebrate also
vertebrate hosts, in environment i.e. intracellular plus extracellular respectively, is through possible by means of a toolkit of additional than 5,000 genes along with their particular proteins with the intention of the parasite to attack and also nurture within numerous cell type furthermore to prevaricate host immune responses (Brian et al., 2008).

There are several stages of development in which parasite passes such as the sporozoites, merozoites, trophozoites, and gametocytes. In the liver cells i.e. the hepatocytes which is also known as exoerythrocytic (or pre-erythrocytic) phase of infection, encompass the salivary glands of the mosquito and expand in it and discharge the sporozoites, initial like schizonts. These refurbish and expulsion merozoites keen on the bloodstream. The Merozoites contaminate the red blood cells everywhere and they develop into trophozoites, schizonts and merozoites, in addition to these are able of reinforcing further erythrocytes. The amount of merozoites formed at the closing stages of the cycle is also species dependant, and it is approximate as 2,000 intended for Plasmodium malariae, 10,000 for Plasmodium vivax/Plasmodium ovale, as well 30,000 for Plasmodium falciparum (Garnham, 1966).

In human host, the malarial infection start as soon as the sporozoites are injected keen on the blood stream at some point in a blood meal via an infectious mosquito. Even though it is believed that individual sporozoite is capable of initiating the disease in men. The numeral sporozoite injected by a mosquito bite is supposed to be altered initiation from dozens to thousands. The sporozoites stays into the transmission proposed for a diminutive period i.e. calculated as 60 minutes at utmost, earlier than they vigorously enter the liver of the host (Lopez-Antunano and Shmunis, 1980). Malaria comprise of different stages i.e. the Exo-erythrocytic stages which contain the sporozoites i.e. it enters the hepatocytes of liver, schizonts i.e the dividing forms of liver stages, merozoites which are released by hepatocytes, hypnozoites i.e. the resting liver stages. The Blood stages comprise of merozoites which enter erythrocytes, trophozoites i.e. feeding and growing stages in red cells, schizonts which is multinuclear stages in red cells and gametocytes. This phase of infection is known as the erythrocytic cycle. The demolition of the red blood cells with the liberation of the parasites destroys the products and manufactures the episodic chills as well as fever so as to differentiate the disease. The entire stages have the control of unique shapes, structures as well as protein complements. The exterior proteins and metabolic pathways remain changing throughout the diverse stages, and this help the parasite to evade in the immune clearance (Laurence et al., 2002).
The representative indication of malaria is a brutal fever continuing 6 to 8 hours, incurable of two or three days. The dissimilar species of Plasmodium source comprise of two types of sporadic fever i.e. a tertian fever which has a single day free of fever flanked by paroxysms; as well as a quartan fever which has two. In children especially, it can cause cognitive impairments. As the disease progresses, enlargement of the spleen develops and it also causes widespread anaemia during the period of rapid brain development in addition to direct brain damage. Children are most vulnerable to this neurologic damage which results from cerebral malaria (Holding and Snow, 2001). Cerebral malaria is linked with retinal whitening, as it might be a clinical sign in differentiating malaria from other causes of fever (Beare et al., 2006). The innovative antimalarial drug which is quinine, have particular way to synthetics such as chloroquine, even though unwilling strains of the most important malaria parasite, Plasmodium falciparum, are scattering speedily. Though approximately 270 million people were infected, it is one of the most persistent diseases, claiming two million lives a year, generally in the tropics, and also the fatality rate can exceed 20% in several cases of the disease (Kain et al., 1998). Conventional plants may balance or invariable restore the efficient drug which is complex to get for the action of malaria (Anon, 1986). The make use of medicinal plants plays a significant role in daily fitness care in mainly rural area.

1.5. MEDICINAL PLANTS

Recently, medicinal plants take an urgent attention for sustainable use. Since age, human relied on nature, planned for their essential requirements, for the fabrication of groceries, protection, garments, haulage, and flavour with fragrance in addition to medicine (Cragg and Newman, 2005). Plants has produced the starting point of complicated long-established medicine systems with the purpose of been in continuation for thousands of years. Moreover maintain to provide with mankind in the midst of new remedies. Even though some of the curative properties were allowed to plants which include medicinal plant therapy which is based on the practical conclusion of hundreds with almost certainly thousands of years engage in recreation. The earliest records, on paper on clay tablets in cuneiform, are from Mesopotamia and date from about 2600 BC (Heinrich et al., 2004). The chemotherapeutic agents are important in natural history as a foundation. In today’s world natural products as well as their derivatives are a symbol of more than 50 % of all the drugs which are in clinical use and the advantaged plants makes an expense no less than 25% on the whole (Farnsworth et al., 1985). The medicinal Plants are used in various traditional systems as well as
complementary in addition to alternate systems of curing of various human diseases. Medicinal Plants are rich in a broad variety of secondary metabolites such as tannins, terpenoids, alkaloids, flavonoids etc which have been found in vitro to have antimicrobial and antioxidant properties (Cowan, 1999; Dahanukar et al., 2000).

India is in the confinement position of enhanced organization of native medication such as Siddha, Ayurveda as well as Unani. The effectiveness of plants depends on the existing taxonomic individuality of plant species which makes the use of suitable plant ingredient along with its natural potency and which in turn depends upon the occurrence of required magnitude in addition to natural world of secondary metabolite in a natural drug. Worldwide estimation indicates that 80% of about 5 billion population cannot come up with the money for the products of the western pharmaceutical industry although they easily get the use of long-established medicines which are from the derivative of plant materials. In this modern world, currently plant based drugs are extensively used as well as many countries contribute 40-50% of their overall, health budget in the fabrication of novel drugs (Karthishwaran et al., 2010; Sati et al., 2010). The present-day allopathic medicine have its roots in primeval medicine, furthermore it is to be expected that numerous imperative new remedies will be revealed as well as commercialized. Ayurveda is possibly on the whole, traditional of all the therapeutic behaviour.

The conception of Ayurveda appears to be flanked by 2500 along with 500 BC in India. The simple association of Ayurveda is “science of life,” since prehistoric time. It is vital that the confirmatory health resources can metabolically well-balance the human beings. According to Ayurveda, the infections develop due to the exterior factors. In Sanskrit, the vast literature is covering all phase of diseases, pharmacy as well as therapeutics. The Ayurveda of therapeutics consists of 8 sections divided into 180 chapters. In addition to listed 314 plants, which are worn as medicines in India (Subhose, 2005), the Indian subcontinent is a vast warehouse of medicinal plants which are used in conventional medical treatment (Ballabh and Chaurasia, 2007). In India, approximately 20,000 medicinal plants have been reported (Dev, 1997) though habitual communities are with only 7,000 - 7,500 plants for therapeutic diverse diseases (Perumal et al., 1998). Still nowadays, majority of the medicines are prepared as of the plant along with animal foodstuffs, minerals as well as metals etc. Main pharmaceutical industry depends on the plant yield for the research of Ayurvedic medicines. In the present perspective, the Ayurvedic system of medicine is broadly accepted but
practiced not only in the Indian Peninsula although also in the developed countries like Europe, United States and Japan. The medicines which are derived from plants have been the primary line of protection in maintaining health as well as combating diseases (Veale *et al.*, 1992). Since Four thousand years, the medicinal knowledge of the Indian subcontinent was termed as Ayurveda. It left over a significant system of medicine along with drug therapy in India. The primary active ingredients of Ayurvedic drugs are plant alkaloids. At present the pharmacologically active ingredients of many Ayurvedic medicines are being identified and only a definite percentage of plants are used in traditional medicines i.e. out of 17,000 species, just about 3,000 species are used in medicinal field (Nayar, 1989).

Regardless of the marvellous advancement in medicine, infectious diseases cause by bacteria, fungi, viruses along with parasites maintain to simulate a threatening meet to public health (Cos *et al.*, 2006). The burden of these diseases is felt for the most part of the countries exceptional to poverty, unavailability of medicines with the materialization of widespread disagreement of pathogens to the obtainable drugs (Okeke *et al.*, 2005). In 2002, WHO have also reported that communicable diseases along with parasitical disease explanation for 26.2% of the worldwide source of death, the huge prevalence of which occurred in the developing countries (WHO, 1993). Each year, half of the deaths are caused by the means of transmittable diseases which leads to three illnesses: HIV/AIDS, Tuberculosis in addition to Malaria. In present, these diseases are in epidemic fraction; furthermore act as major obstacles to the economic growth with improvement in numerous of the poorest countries in the world (Mandell *et al.*, 2005).

The exploitation of vegetation for wellbeing care have existed for centuries moreover still on disappearing nowadays. Olden times reveal that the vegetation has been considered as an imperative resource of medication for human being. For thousands of years, phytomedicines have been used as a fundamental part of conventional health care system on the whole parts of the world (Rath *et al.*, 2009). Therapeutic vegetation naturally contains dissimilar chemical compounds that possibly will act independently. An individual plant may possibly, enclose astringent substances that stimulate digestion, anti-inflammatory compounds that diminish swellings as well as pain, phenol compounds that can proceed as antioxidant along with venotonics, anti-bacterial, furthermore, anti-fungal that act as innate antibiotics, diuretic substances with the purpose of devastate products, toxins and furthermore alkaloids (Gurib-Fakim, 2006).
Over three-quarters, population of the world depended upon plants and their extracts for healthiness and from the complete plant species, more than 30% were used for medicinal purposes at a single time or after everything else. These medicinal plants comprise an efficient source in cooperation with traditional and modern medicine. About 80% population of the country depends on them as prime health care and these plants have been exposed to have dependable efficacy (Akinyemi, 2000). For the treatment of many diseases, these Plants have been used as sources of remedies for the handling of countless diseases since prehistoric times and citizens of all continents, mainly, Africa have this old tradition. In twentieth century, although there was an amazing growth in synthetic organic medicinal products, even then over 25% of approved medicines in modern countries are derived directly or indirectly from plants (Newman et al., 2000). On the other hand, studies are still going on in plants which are used in conventional medicines (Kirby, 1996). Insertion of diverse bioactive compounds from medicinal plants permits the appearance of their physiological movement. It also facilitates pharmacological study leading to the mixture of an additional effective drug with compact toxicity (Ebana et al., 1991; Manna and Abalaka, 2000). In addition, the vigorous components of herbal products have the benefit of being shared with many other substances that become visible to be inactive and these balancing components give the plant a complete safety and effectiveness much better to that of its isolated and pure active components (Shariff, 2001).

1.6. EXTRACTION

Traditional methods of extraction of necessary oils are most widely used on commercial scale. Conversely, with technical development, new techniques have been developed which might not essentially be widely used for commercial fabrication of essential oils but are measured valuable in the production of expensive essential oils in a natural state devoid of any alteration of their thermo sensitive components otherwise for the extraction of essential oils for micro-analysis.

Plants includes a broad spectrum of metabolites, as many as 200,000 diverse compounds (Fiehn, 2002), even though not every metabolite occurs in each species. These metabolites represent lots of different classes of compounds and their derivatives such as amino acids, fatty acids, carbohydrates, and organic acids. The physical and chemical properties of the metabolites are extremely variable. As a result appropriate extraction protocols have to be preferred, as the optimum extraction surroundings differ extensively for
different types of compounds. Various techniques such as grinding with a mortar and pestle simultaneously with liquid nitrogen, milling in vibration mills with chilled holders, homogenization with a metal pestle connected to an electric drill (Edlund et al., 1995) as well as ultra-turrax devices (Orth et al., 1999) are available. The most widespread way to extract metabolites is to shake the homogenized plant at low or high temperatures in organic solvents, or mixtures of solvents (Fiehn et al., 2000). Methanol, ethanol, and water are the solvents which are mainly used for extracting polar metabolites, but chloroform is the most widespread solvent for non-polar ones. Different extraction techniques such as Soxhlet, Microwave assisted extraction (MAE) in addition to Supercritical fluid extractions (SFE) (Lopez-Sebastian et al., 1998) have been used to separate antioxidants from the plants. Each extraction technique has its own advantages and disadvantages. The liquid–solid extraction procedures are time consuming and require large amounts of solvents which sometimes are hazardous compounds. The various solvents that are used in extraction procedures are petroleum ether, benzene, methanol, chloroform, ethyl acetate and water.

Soxhlet extraction is simply required where the required compound has a limited solubility in the solvent, and the impurity is insoluble in that solvent. If the required compound has a high solubility in the solvent, subsequently a simple filtration can be used to divide the compound from the insoluble substance. The advantage of soxhlet extraction is that instead of numerous portions of warm solvent being passed during the sample, only one batch of solvent is recycled. This process cannot be used for thermolabile compounds as long-standing heating may lead to degradation of compounds (Nikhal et al., 2010).

1.7. PHYTOCHEMICAL SCREENING

The conventional Indian systems of medicine have an extensive history of use and the natural compounds formed are the base of modern drugs as we use today (Edeoga et al., 2005). ‘Phyto’ is the greek word used for the plant. There are numerous families of phytochemicals as well as they help the human body in a variety of ways. Phytochemicals possibly will protect human from a variety of diseases. Phytochemicals are non-nutritive plant chemicals which have protective or disease preventative properties. They are mostly divided into two groups i.e. Primary metabolites and Secondary metabolites, based on their functions in plant metabolism. Primary metabolites comprises of common sugars, amino acids, proteins and chlorophyll, where as secondary metabolites comprises of alkaloids, flavonoids, tannins, terpenes, and saponins (Parekh et al., 2007). Phytochemical screening
was performed to calculate the qualitative chemical composition of various crude extracts with commonly employed in precipitation in addition to coloration reactions to categorize the major metabolites (Trease and Evans, 1989).

1.8. THIN LAYER CHROMATOGRAPHY (TLC)

For the study and classification of both simple as well as complex lipid classes, chromatographic methods are most widely used (Christie, 1982). TLC is a variation of column chromatography which separates the mixtures of compounds. It utilizes a band of glass, plastic, or aluminium as a support to a plate along with a thin layer of silica gel as the adsorbent. TLC is an analytical tool that offers frequent advantages over previous forms of chromatography. It is easy, simple, rapid and inexpensive and also it requires only a little amount of sample. It is normally used for checking the transparency of the compound or determining the number of components in the mixture (Fessenden et al., 1993). On the other hand it can also be used quantitatively. It can also be used to follow the course of reaction by identifying the loss of a starting material, and the development of a product and also used to recognize the species present in an unknown sample by co-analyzing a known compound, or standard. The other way is to identify the species present is by calculating the retention factor ($R_f$) for the particular compound. The $R_f$ value is defined as the distance travelled by the compound divided by the distance travelled by the solvent. If the variables such as temperature, solvent mixtures, atmosphere in tank, adsorbent, thickness of adsorbent, amount of compound on plate, and the distance the solvent travels are constant then the $R_f$ value for the particular compound is also constant.

1.9. HIGH PRESSURE LIQUID CHROMATOGRAPHY (HPLC)

HPLC (High Pressure Liquid Chromatography) is a modern technique in which dissimilar compounds or mechanisms of a sample are separated by passing a mobile phase throughout a column, which is known as stationary phase. The separation is based on the variation in the affinities of stationary phase packing material in the direction of various mechanisms in the sample. HPLC is categorised into normal as well as reverse phase based on the stationary phase packing material used. In normal phase HPLC, the stationary phase is comparatively polar in nature (silica) in addition to the mobile phase which is non-polar in nature such as hexane. This is usually used for the separation of non-polar molecules. In the reverse phase HPLC, generally polar solvents are used as mobile phases. In this process, the stationary phase is prepared of a non-polar material (e.g. C$_{18}$ column) along with the
separation is based on the hydrophobic interaction among the compounds also the stationary phase. This is commonly used for the partition of polar molecules, which are readily soluble in water. A lot of the natural products like as fruits, vegetables and the herbs enclose phenol and other compounds that act as antioxidants and are soluble in water. This is the major reason for the utilization of reverse phase HPLC with non-polar C\textsubscript{18} stationary phase in the partition as well as classification of many antioxidants from natural products.

The common antioxidant compounds in plants such as flavonoids as well as polyphenols which are polar and readily soluble in water. Consequently, the separation of these compounds is typically done by reverse phase HPLC with a C-18 column with a guard column. A guard column is generally used for the protection of the reverse phase C\textsubscript{18} column from blockage by the impurities which are present in the sample or solvents (Milbury, 2001).

1.10. FREE RADICALS AND REACTIVE OXYGEN SPECIES

Oxygen is essential for the survival of all on this earth. Though oxygen is important for life, overload of oxygen can have injurious effects. When oxygen is metabolised by the body it creates substances called free radicals and this cause damage to our cells. Free radicals can also be produced by revelation to pollution, fatty foods and cigarette smoke. The development of conditions such as heart and liver disease, some cancers, arthritis, accelerated ageing and eyesight deterioration are thought to be related to the extreme amounts of free radicals. The body has its own natural defences aligned with free radicals, but these systems from time to time be overhauled.

Free radicals are molecules or atoms with unpaired electrons. These radicals are formed in the cells as by-product of normal oxidation. Mainly of these radicals is reactive oxygen species (ROS) formed for the duration of normal cell aerobic respiration (Gutteridge and Halliwell, 2000). Reactive oxygen species are oxygen derived chemically reactive molecules (Fridovich, 1999; Halliwell, 1999; Halliwell, 1996). Free radicals and ROS act in response with numerous biomolecules and start a chain reaction. These reactions only end as the free radicals are eliminated; the generated free radical reacts among another free radical or as soon as it reacts with a chain breaking or primary antioxidant.

The occurrence of phenolic compounds, are connected with many properties of plant products and they are important for the growth of plant and also plays a significant role in their defence mechanisms. These compounds are favourable to human health, may be by
lower occurrence of diseases when present in the normal diet. Molecules of active oxygen such as (O$_2^-$, OOH), hydroxyl (OH*) and peroxyl (ROOH*) radicals take part in the significant role in oxidative strain linked to the pathogenesis of a variety of essential diseases. The manufacture of free radicals is independent by antioxidative defence process, in healthy individuals (Halliwell, 1997).

1.11. ANTIOXIDANTS

Antioxidants are naturally occurring nutrients in food which helps in destroying these free radicals and minimise damage to our cells (Omenn et al., 1996). Some examples of antioxidants are beta-carotene, lycopene, vitamins C, E, and A and other substances. Antioxidant refers to a compound which is capable of interruption or else reduce the oxidation of lipids or molecules by inhibiting the initiation otherwise proliferation of oxidative sequence reaction along with which are able to therefore prevent or destroy body’s cells by oxygen. They take steps by single or else additional of the subsequent mechanism: plummeting movement, free radical-scavenging, prospective complexion of pro-oxidant metals along with quenching of singlet oxygen. Epidemiological study revealed that many phytonutrients of fruits in addition to vegetables may defend the human body aligned with injure by ROS. The consumption of accepted antioxidant phytochemicals has the potential of health benefits (Carlo et al., 1999; Pulido et al., 2000; Sumino et al., 2002).

1.11.1. Antioxidants Classification Based On Their Sources

The antioxidants can be classified into two classes based on their sources i.e. natural or synthetic antioxidants. Natural antioxidants are extracted from plant and animal sources. Synthetic antioxidants are prepared synthetically in the laboratory.

1.11.1.1. Natural Antioxidants

The Natural antioxidants are tocopherols as well as vitamin C and they are able to act as primary antioxidants furthermore are efficient radical scavengers. Others naturally occurring antioxidants such as thiols, sulfides, free amino groups of proteins, carotenoids are able to act as secondary antioxidants. Citric acid and phytic acid are also the chelating agents which also exist naturally. In cells the antioxidants are also present such as superoxide dismutase, enzymes which are able to metabolize reactive oxygen species, superoxide reductase are able to catalyzes direct reduction of superoxide, catalases that catalyze dismutation of hydrogen peroxide to water moreover molecular oxygen, glutathione-related systems, selenium compounds, lipoic acid, and ubiquinones are other examples of naturally
occurring antioxidants (Pokorny, 1991). A number of other natural antioxidants are Organic acids, such as citric acid and phytic acid which are able to act as chelating agents by binding metal atoms moreover prevent them from initiate radicals. Polyphenolic compounds are also a significant assembly of natural antioxidants. Phenols enclose single aromatic ring through a smallest amount of one hydroxyl group. Polyphenols enclose a smallest amount of two aromatic rings with a minimum of one hydroxyl group in each aromatic ring (Lazarus et al., 2001). Flavonoids are also the polyphenolic antioxidants and they are classified into six classes; which are flavones, flavanones, isoﬂavones, flavonols, flavanols, and anthocyanins (Rice-Evans and Miller, 1997).

1.1.1.2. Synthetic Antioxidants

Synthetic antioxidants are those which are organized unnaturally in the laboratory. These are normally phenolic compounds. Consequently, the method of their reaction by means of radicals is the similar as that of phenolic antioxidant compounds, i.e. they act as chain breaking antioxidants moreover involve in transfer of a hydrogen atom or an electron to radicals. In this category, the antioxidants such as butylated hydroxyanisole (BHA) and butylated hydroxyltoluene (BHT) are improved by delocalization of electrons subsequent to the donation of a hydrogen atom.

It has been recognized that the function of free radicals in addition to active oxygen was in the pathogenesis of human being diseases together with cancer, aging as well as atherosclerosis (Halliwell and Gutteridge, 1992). The electron acceptors like as molecular oxygen, react speedily by way of free radicals to turn out to be radicals themselves which is also referred to as reactive oxygen species (ROS). The ROS embrace superoxide anions (O$_2^-$), hydrogen peroxide (H$_2$O$_2$) in addition to hydroxyl radicals (•OH) (Grisham and McCord, 1986). Lipid peroxidation, involve a sequence of free radical mediate chain reaction process which is also connected by means of numerous type of organic damage. Consequently the use of antioxidants, more than ever natural antioxidant is to slow down peroxidation in addition to defend from injures outstanding to free radicals. It is on form known that reactive oxygen species (ROS) perverse in vivo, such as superoxide anion, hydroxyl radical as well as hydrogen peroxide. These are highly reactive along with potentially destructive transient chemical species. Tissue injure significant from an imbalance flanked by ROS-generating also scavenging systems have been concerned in the pathogenesis of a assortment of disorder, together with degenerative disorders of the CNS, such as Alzheimer’s disease, cancer,
atherosclerosis, diabetes mellitus, hypertension, AIDS furthermore aging (Halliwell and Gutteridge, 1998; Mantle et al., 2000). Aerobic organisms are repeatedly subjected to reactive oxygen species (ROS), the derivative of oxygen generate as by-products throughout cellular metabolism in addition to previous exogenous ecological factors like as ozone, UV light, different xenobiotics, ionizing radiation herbicides, tobacco smoke, as well as pesticides (Halliwell and Gutteridge, 1999). Oxidative pressure, as a consequence of disproportion sandwiched between the antioxidant resistance systems in addition to the configuration of ROS, possibly will demolish up to cellular bio molecules like as DNA, RNA, proteins, enzymes, carbohydrates, as well as lipids all the way through oxidative alteration along with causative to the pathogenesis of human being diseases (Prakash et al., 2007).

1.12. IMPORTANCE OF ANTIOXIDANTS

In current years, there have been an increasing significance in the apparent efficient foods for the reason that they can make available physiological remuneration supplementary to dietary in addition to vigorous, as for illustration, antihypertensive, antioxidant or else anti-inflammatory (Goldberg, 1996). Flanked by the dissimilar compounds with well-designed properties, the antioxidants are the most broadly studied (Halliwell, 1996, Herrero et al., 2006, Fogliano and Vitaglione, 2005). The antioxidants can also cooperate an imperative role in groceries technology for the reason that of their convenience aligned with lipid peroxidation, more often than not food production procedure as well as storage can produce imperative fatalities of endogenous antioxidants that edge their own reinforcement adjacent to lipid corrosion. Furthermore, the significant role of antioxidants in human being health has been recognized and the vegetal kingdoms have turn out to be the main source of antioxidant compounds. Along with them the main families are phenolic compounds, carotenoids as well as tocopherols (Senorans et al., 2003, Plaza et al., 2008). Cell injury caused by free radicals appear to be a most important provider to age as well as to degenerative disease of aging such as cancer, cardiovascular disease, cataracts, immune system decline, in addition to brain dysfunction (Sies et al.,1999). On the whole, free radicals concerned in the pathogenesis of at slightest 50 diseases (Langseth, 1993, Halliwell, 1994). The free radicals are electrically charged molecules, i.e., they include an unpaired electron, which cause them to search somewhere else furthermore confine electrons on or after other substance in command to counterbalance themselves. Even though the primary attack causes the free radical to turn out to be neutralized, a different free radical is twisted in the progression, causing a chain
Innate antioxidants like flavonoids, phenolics, tannins, curcumin in addition to terpenoids are bringing into being in a variety of plants (Prakash et al., 2007). These antioxidants have the capability to search oxygen-nitrogen-imitative free radicals by donating hydrogen atom or else an electron, activating antioxidant enzymes, chelating metal catalysts, along with inhibiting oxidases (Ardestani and Yazdanparast, 2007). In recent decades, a remarkable importance is based on accumulative verification which has considerably greater than before in innate substances i.e. antioxidant which is in attendance in foods or else therapeutic plants to restore imitation antioxidants, which are being inhibited owing to their elevation effects.

In nature, Antioxidants occurs naturally which composed of a broad variety and these are different in their properties i.e. in their physical and chemical properties, composition, mechanism and site of action (Naik, 2003) and out of them the main categories are as follows:

**Vitamins:** Vitamin A, Vitamin C and Vitamin E are the well-liked antioxidants. These vitamins play an important role in preventing per oxidation damage in the biological system (Fogliano et al., 1999). Vitamin C is an incredibly significant antioxidant in addition to it is in attendance in quite a few fruits along with vegetables. An extremely significant antioxidant i.e. ascorbate which is a water soluble antioxidant present in human plasma along with cell membranes (May, 1999, Frei et al., 1990). It reduces tocopherols, peroxides, as well as ROS like as super oxides (Buettner, 1993). It also prevent lipid per oxidation, along with it also prevents LDL oxidation. It is ready to provide a dispense in avoidance of configuration of atherosclerotic plaque (Chopra and Thurnham, 1999; Sies et al., 1999). Within the cell, ascorbate in addition to GSH acts in a synergistic fashion to defend the cell on or after oxidation (Meister, 1995).

**Enzymes:** The well known enzymes like Superoxide Dismutase (SOD), Catalase (CAT), Glutathion Peroxidase (GPx) are there in plasma and they perform as antioxidants by transforming reactive oxygen and nitrogen species into the steady compounds (Prior et al., 1998).
Minerals: Mineral deposits similar to selenium, copper, manganese, zinc, etc. are the glowing antioxidants (Shirwaikar et al., 2004). At the present days chromium is also used in antioxidant formulation.

High Molecular Weight Compounds: Proteins like albumin, transferin and ceruplasmin. It includes high molecular weight compounds which limits the fabrication of metal catalyse free radicals (Khanam et al., 2004).

Low Molecular Weight Compounds: Antioxidants are classified into two broad categories, i.e. depending on whether they are soluble in water i.e. water soluble antioxidants (hydrophilic) or in lipids i.e. lipid soluble antioxidants (hydrophobic). Some lipid soluble antioxidants are Tocopherol, quinines, bilirubin and some polyphenols; and the water soluble antioxidants are ascorbic acid, uric acid and some polyphenol (Blois, 1958).

Plants as Antioxidants: The naturally occurring antioxidants like ascorbic acid, carotenoids and phenolic compounds are more effective among others (Duh et al., 1999). The swot done on medicinal plants stoutly supports the idea that plant constituents with antioxidant action are able of exerting protecting effects beside oxidative stress in biological systems (Cao et al., 1996). On prolongation of our experimental work for the search of antioxidant activity of medicinal plants, we studied extracts of twenty medicinal plants.

1.13. PROBLEM STATEMENT

Plants as most vital chemical factories having bioactive reservoirs with various therapeutic potentials. Due to Environmental disasters various diseases are epidemic underway, it is high time to work on various aspects of natural disasters to provide safe and useful drugs for the future so that the environment will be as a best sustainable place. Therefore, in present work attempts were made on Twenty Indian Medicinal Plants with ethnomedicinal background having a source of antioxidant agents using radical scavenging experiments based on DPPH Assay methods of Takao et al., 1994 to enhance the free radicals capturing power and potentials to decrease anaemia and rationally decrease malaria which is epidemic underway. Simultaneously, chemical screening, TLC and HPLC will also aid a phytochemical sketch of the plant profile to justify its role in the current context. Even some of the plants with potential source of antioxidant agents will lead to suitably used as herbal drinks to cure various diseases and their role in nutraceuticals.
1.14. **EULOPHIA CAMPESTRIS** Wall. (SALAM-GATTA)
   1.14.1. Scientific Classification
   1.14.2. Introduction
   1.14.3. Description
   1.14.4. Chemical Constituents
   1.14.5. Medicinal Properties

1.15. **PIPER RETROFRUCTUM** Vahl (CHVYA)
   1.15.1. Scientific Classification
   1.15.2. Introduction
   1.15.3. Description
   1.15.4. Chemical Constituents
   1.15.5. Medicinal Properties

1.16. **PARNASSIA NUBICOLA** Wall. ex Arn. (NIRVANSHI)
   1.16.1. Scientific Classification
   1.16.2. Introduction
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   1.16.4. Medicinal Properties

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   1.17.1. Scientific Classification
   1.17.2. Introduction
   1.17.3. Description
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1.18. **ZIZYPHUS SATIVA** (UNNAB)
   1.18.1. Scientific Classification
   1.18.2. Introduction
   1.18.3. Description
   1.18.4. Chemical Constituents
   1.18.5. Medicinal Properties
1.19. *Rivea Hypocrateriformis* (Desr.) Chiory (PHANG)
   1.19.1. Scientific Classification
   1.19.2. Introduction
   1.19.3. Description
   1.19.4. Chemical Constituents
   1.19.5. Medicinal Properties

1.20. *Breynia Retusa* (Dennst.) Alston. (RAS-KASAY)
   1.20.1. Scientific Classification
   1.20.2. Introduction
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   1.21.1. Scientific Classification
   1.21.2. Introduction
   1.21.3. Description
   1.21.4. Chemical Constituents
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1.22. *Solanum Surattense* Schrac & Wendle (BHAT-KATELI)
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   1.22.3. Description
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1.23. *Cichorium Intybus* L. (KASANI)
   1.23.1. Scientific Classification
   1.23.2. Introduction
   1.23.3. Description
   1.23.4. Chemical Constituents
   1.23.5. Medicinal Properties
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   1.24.2. Introduction
   1.24.3. Description
   1.24.4. Chemical Constituents
   1.24.5. Medicinal Properties

1.25.  *ONOSMA BRACETATUM* Wall. (SEDGE)
   1.25.1. Scientific Classification
   1.25.2. Introduction
   1.25.3. Description
   1.25.4. Chemical Constituents
   1.25.5. Medicinal Properties

1.26.  *CITRULLUS COLOCYNTHIS* (L.) Schrad. (BITTER CUCUMBER)
   1.26.1. Scientific Classification
   1.26.2. Introduction
   1.26.3. Description
   1.26.4. Chemical Constituents
   1.26.5. Medicinal Properties

1.27.  *DATURA INOXIA* Mill. (DATURA)
   1.27.1. Scientific Classification
   1.27.2. Introduction
   1.27.3. Description
   1.27.4. Chemical Constituents
   1.27.5. Medicinal Properties

1.28.  *RICINUS COMMUNIS* L. (CASTOR)
   1.28.1. Scientific Classification
   1.28.2. Introduction
   1.28.3. Description
   1.28.4. Chemical Constituents
   1.28.5. Medicinal Properties
1.29. *QUERCUS INFECTORIA* L. (MAJUPHAL)
   1.29.1. Scientific Classification
   1.29.2. Introduction
   1.29.3. Description
   1.29.4. Chemical Constituents
   1.29.5. Medicinal Properties

1.30. *LINUM USITATISSIMUM* L. (LINSEED)
   1.30.1. Scientific Classification
   1.30.2. Introduction
   1.30.3. Description
   1.30.4. Chemical Constituents
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1.31. *SOLANUM NIGRUM* L. (MAKOY)
   1.31.1. Scientific Classification
   1.31.2. Introduction
   1.31.3. Description
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1.32. *CURCUMA LONGA* L. (TURMERIC)
   1.32.1. Scientific Classification
   1.32.2. Introduction
   1.32.3. Description
   1.32.4. Chemical Constituents
   1.32.5. Medicinal Properties

1.33. *ACORUS CALAMUS* L. (VASA)
   1.33.1. Scientific Classification
   1.33.2. Introduction
   1.33.3. Description
   1.33.4. Chemical Constituents
   1.33.5. Medicinal Properties
1.14. **EULOPHIA CAMPESTRIS** Wall. (SALAM GATTA)

1.14.1. Scientific Classification

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<td>Other Names</td>
<td>English name-Salep, Hindi name –Salam, Sanskrit name –Munjatak, Gujarati name –Salab.</td>
</tr>
</tbody>
</table>

1.14.2. Introduction

*E. campestris* was used to be made from the dried tubers of several species of Orchis and related genera such as the Anacamptis pyramidalis. The tubers are gathered, scalded, and dried quickly and this process removes their bitterness and disagreeable odour, as well as renders them somewhat translucent. The stem of the plant is 1 to 3 feet. At the apex of the stem there arise the 2 to 6 inch long ovate shaped leaves. Flower presentation is 1 to 6 inch long that has 2/3 inch long flowers which are of purple colour. The rhizome is round which is yellow to brown in colour.

1.14.3. Description

It is found in the levels of 8000 to 12000 feet. It is also found in Tibetan region, western Himalayan region.

1.14.4. Chemical Constituents

The rhizome contains a bitter compound and a volatile oil. It contains moisture which constitutes 14 % and ash that is 3%. The leaves of the plant contain loroglossin.

1.14.5. Medicinal Properties

It is vata pitta suppressant and it strengthens the nervous system and also brain. It helps in gaining strength in the body and avoids the weakness. The parts that are most
frequently used are the stems and the bulbs because they are said to be the life of the plants. Once they are dried up they can be powdered and used as desired. The powder of plant is being used mainly as the aphrodisiac agent and improves the general health condition of the body. The flower, on the other hand, is also dried and used as tea. This product is considered to be excellent and extremely exclusive. *E. campestris* have Phytochemicals and antioxidant properties that can be used to cure various illnesses.

1.15. **Piper Retrofractum** Vahl (CHVYA)

1.15.1. Scientific Classification

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<td>Botanical name</td>
<td><em>Piper retrofractum</em> Vahl</td>
</tr>
<tr>
<td>Plant Part Used</td>
<td>Fruit</td>
</tr>
</tbody>
</table>

1.15.2. Introduction

Piper, the pepper plants or pepper vines, are an economically and ecologically important genus in the family Piperaeae. It contains about 1,000-2,000 species of shrubs, herbs, and lianas, many of which are keystone species in their native habitat. The diversification of this taxon is of great interest to the evolution of plants. Pepper plants belong to the magnoliids, which are angiosperms but neither monocots nor eudicots.

Their family, Piperaeae, is most closely related to the lizard tail family (Saururaceae), which in fact generally looks like smaller, more delicate and amphibious pepper plants. Both families have characteristic tail-shaped inflorescences covered in tiny
flowers. A somewhat less close relative is the pipevine family (Aristolochiaceae). A well-known and very close relative is also part of the Piperaceae which are the radiator plants of the genus Peperomia.

1.15.3. Description

Piper species have a pan tropical distribution, and are most commonly found in the understory of lowland tropical rainforests, but can also occur in clearings and in higher elevation life zones such as cloud, forests. Mostly piper species are either herbaceous or vines, some of them grow as shrubs or almost as small trees. The fruit of the Piper plant is called a peppercorn which is round and pea-sized.

1.15.4. Chemical Constituents

*P. retrofractum* comprises of 39.50 % Starch, 5.80 % Fibers, 5.90 % Ash and 9.50 % Moisture.

1.15.5. Medicinal Properties

It is valued for various feverish diseases, including liver disorders with jaundice, and for migraine headache. In Malaysia it is used as a postpartum tonic. It is a component of digestive and sudorific (sleep-inducing) preparations. The roots are chewed for toothache and the root decoction is used for digestive disorders including stomach ache. It is included in many tonics, and it is used to disperse liver congestion.
1.16. **PARNASSIA NUBICOLA** Wall. ex Arn. (NIRVANSHI)

1.16.1. Scientific Classification

- **Kingdom**: Plantae
- **Subkingdom**: Viridaeplantae
- **Phylum**: Magnoliophyta
- **Subphylum**: Euphyllophytina
- **Infraphylum**: Radiatopses
- **Class**: Magnoliopsida
- **Order**: Parnassiales
- **Family**: Parnassiaceae
- **Genus**: Parnassia
- **Species**: nubicola
- **Botanical name**: Parnassia nubicola Wall. ex Arn.
- **Plant Part Used**: Whole Plant

1.16.2. Introduction

*P. nubicola* is a perennial herb which is simply distinguished by its solitary white flower borne on a slender stem 11-30 cm tall, with a single stalk less, stem-clasping ovate leaf arising from below to the middle of the stem, and many stalked leaves at the base. Stems 3 or 4(or 5), (5-) 13-40 cm, with 1 leaf near base or in proximal 1/4. Basal leaves 3-8; petiole 3-7(-13) cm; leaf blade abaxially greenish, adaxially deep green or brown-green, elliptic or ovate-oblong, rarely oblong, (2-)2.5-7.5 × (1.5-)2-3.8 cm, thick textured or thin and papery, base subcuneate, sometimes truncate, apex acute or shortly acuminate.

Cauline leaf similar to basal ones but smaller, often with a few rusty brown appendage at base. Flower 2.8-3.4 cm in diameter, hypanthium campanulate. Sepals densely brown punctate, ovate-oblong or ovate-lanceolate, ca. 8 × 3 mm, margin entire, apex obtuse. Petals white, purple-brown punctate, broadly ovate, 1.2-1.6 cm × 8-10 mm, base contracted into a claw 2-3 mm, margin entire or erose proximally, apex rounded. Anthers ellipsoid, 0.8-1.1 mm; filaments ca. 4.5 mm; staminodes flat, 4-5 mm, stalk ca. 2 × 1 mm, lamina 3-lobed for 1/5-1/4(-1/2) its length, lobes lanceolate or ovate-lanceolate. Ovary semi-inferior, ovoid; style ca. 2 mm; stigma 3-lobed. Capsule ovoid, 3- or 4-lobed. Seeds are brown, glossy and oblong.

1.16.3. Description
It is found in the Himalayas, from Afghanistan to SE Tibet, at altitudes of 2900-4300 m. The flowering season is July to September.

1.16.4. Medicinal Properties

Its root paste is taken to get relief from cuts & wounds. The leaf juice is applied to treat eye problems and inflammation.

1.17. **VALERIANA WALLICHII** (TAGAR)

1.17.1. Scientific Classification

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<td>Rhizome</td>
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1.17.2. Introduction

*V. wallichii* commonly known as Indian valerian is one of the most important plant species of commerce, which belongs to the family Valerianaceae. It is native to India (Himalayas). Indian valerian is used in a variety of pharmaceutical preparations for the treatment of migraine. The active constituent of the root of this plant is valerenic acid, valerenol, valerenone, valtrate, Isovaltrate.

1.17.3. Description

The plant root occurs in short, irregular pieces about 5 cm long and 6-12 cm in diameters marked with transverse ridges and bearing numerous, prominent, circular tubercles, to some of which on the under surface, thick rootlets are attached. The upper surface bears the remains of leaves. The rhizome is hard and tough internally and is greenish-brown in colour. The odour is powerfully valerianaceous (Youngken, 1950).

*V. wallichii* is an extremely polymorphous complex of sub-species with natural populations distributed throughout temperate as well as sub-polar Eurasian zones. This species is common in damp woods, ditches, and along streams in Europe, and is cultivated as
a medicinal plant, especially in Belgium, England, Eastern Europe, France, Germany, India, the Netherlands, the Russian Federation, and the United States of America.

1.17.4. Chemical Constituents

Its main chemical components are valeric acid, valerenic acid, valechlorine, valerine, limonene, choline, chatinine, valerianine, actinidine, tannins, resins as well as alkaloids.

1.17.5. Medicinal Properties

Tagar is a wonderful Ayurvedic herb that is used to induce sleep naturally. It is a powerful and effective natural herb that is used to treat insomnia. It has numerous medicinal properties that make it a wonderful herb which is used since ancient times in Ayurveda to make different products. Roots of the plant are used to make different medicines. It helps to reduce the stress and induce sleep.

Tagar is especially a good product for nervous disorders in addition to skin diseases. It is very useful for external application in skin diseases like as eczema, psoriasis, itching of the skin, redness, boils etc. It is also helpful in the treatment of the ulcers of the skin wherever on the body. The leaves of the plant are used to make a paste and to be applied on the affected part of the skin. It also helps in treating the acne and the scars created by them. It is widely used all over the world for its tranquillizing properties.

Tagar is a very good anti-epileptic agent. It also helps in reducing the pain as well as blood pressure effects. It is a wonderful drug for digestive problems such as constipation, diarrhea, constipation and digestive ulcers. It acts as a natural laxative and helps to clean up the system by removing the toxins and wastes from the body. It is also a fine ayurvedic product for respiratory infections and a wonderful drug in the treatment of the infections such as cough, cold, asthma and other respiratory diseases. It also helps in reducing the fever associated with the infection. It helps to relieve the breathlessness and wheezing associated with the cough.
Fig: 1.1. Plant of *E. campestris*

Fig: 1.2. Plant of *P. retrofractum*

Fig: 1.3. Plant of *P. nubicola*

Fig: 1.4. Plant of *V. wallichii*
1.18. **ZIZYPHUS SATIVA (UNNAB)**

1.18.1. Scientific Classification

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</table>

1.18.2. Introduction

*Zizyphus* is a genus of about 40 species of spiny shrubs and small trees in the buckthorn family, Rhamnaceae which is distributed in the warm-temperate and subtropical regions throughout the world. The leaves are alternate, entire, with three prominent basal veins, and 2–7 cm (0.79–2.8 in) long; some species are deciduous, others evergreen. The flowers are small, inconspicuous yellow-green. The fruit is an edible drupe, yellow-brown, red, or black, globose or oblong, 1–5 cm (0.39–2.0 in) long, often very sweet and sugary, reminiscent of a date in texture and flavour.

1.18.3. Description

A shrub or a small tree of the family Rhamnaceae, which grows on the shores of the Mediterranean and cultivated in Italy, Spain, and the south of France. The part used is fruit which consists of oval drupes, of the size of a large olive, with a thin, coriaceous, red or reddish-brown skin, a yellowish, sweet, acidulous pulp, and an oblong, pointed stone in the centre. These are also having the name of jujube. Jujube is widely cultivated China and India. When their pulp dries it becomes softer and sweeter, and acquires a vinous taste. They are nutritive and demulcent, and are used in the form of decoction. This Jujube paste consists
properly of gum Arabic and sugar which dissolved in a decoction of this fruit and evaporated to the proper consistence.

1.18.4. Chemical Constituents

_**Z. sativa**_ contains two Cyclopeptide alkaloids i.e. sativanine-N and sativanine-O which were isolated from the stem bark of this plant (Singh _et al._, 2006).

1.18.5. Medicinal Properties

The fruits have medicinal use and are considered to be cooling and tonic. Their small acid fruits are liked by children as well as by adults. It is a small spreading tree, with drooping branches grows readily and quickly on poor ground and even moderately saline soils is tolerated. The tree will flourish without any special care and all parts of the plant have medicinal uses.

1.19. **RIVEA HYPOCRATERIFORMIS** (Desr.) Chiory (PHANG)

1.19.1. Scientific Classification

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
</thead>
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<tr>
<td>Division</td>
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<td>Rivea</td>
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<tr>
<td>Species</td>
<td>hypocrateriformis</td>
</tr>
<tr>
<td>Botanical Name</td>
<td>Rivea hypocrateriformis (Desr.) Chiory</td>
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<tr>
<td>Plant Part Used</td>
<td>Leafs</td>
</tr>
<tr>
<td>Found In</td>
<td>India and Nepal</td>
</tr>
<tr>
<td>Popular Names</td>
<td>Common night glory</td>
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</tbody>
</table>

1.19.2. Introduction

_**R. hypocrateriformis**_ is also known as Midnapore Creeper. Flowers are creamy white, typical morning glory form. Leaves are boiled in water and then added to bajri (millet) or jowari flour which is made into bread. Leaves are also boiled together with condiments, i.e. prepared into bhaji. In Rajasthan, young shoots and leaves are eaten as vegetable. The leaves
are ovate-orbicular, appressedly silky-hairy beneath. The leaves of this plant also possess the anti-inflammatory property.

1.19.3. Description

It is a robust woody climbing shrub, found in dry subtropical forests of India and Pakistan. It grows in higher humid conditions such as the river bank.

1.19.4. Chemical Constituents

The phytochemical constituents of the *R. hypocrateriformis* leaves were isocoumarin, desmethylbergenin hemihydrate 3, 4, 8, 9, 10 pentahydricky-2-hydroxy-methyl-2, 3, 4, 4a, 6, lob-hexa hydrophyran (3,2-c) isochromen-6 onehemihydrate, C_{13}H_{14}O_{9}O_{5}.H_{2}O (Zamarrud *et al.*, 2006). The leaves were collected, dried, powdered and extracted with 95% v/v alcohol.

1.19.5. Medicinal Properties

The leaves of *R. hypocrateriformis* have been used to treat bleeding, diarrhoea and dysentery. Roots can be used in the treatment of snake bites. It is also used as astringent, antidote, antidiarrhoeal, antidysentric.

1.20. *BREYNIA RETUSA* (Dennst.) Alston. (RAS-KASAY)

1.20.1. Scientific Classification

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<tr>
<td>Family</td>
<td>Euphorbiaceae</td>
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<td>Breynia</td>
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<tr>
<td>Species</td>
<td><em>retusa</em></td>
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<tr>
<td>Botanical Name</td>
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<tr>
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<td>Leafs</td>
</tr>
<tr>
<td>Other names</td>
<td>Cup saucer plant, Cupped coral-berry tree</td>
</tr>
</tbody>
</table>

1.20.2. Introduction
B. retusa is also known as Cup Saucer Plant which is a shrub with spreading branches. Its striking feature is its fruit, which looks like a berry kept on a saucer, or a cup kept on a saucer to many. Bark extract is use for preservation of fishing nets. Flowers are small axillary make pale yellow and female pale green.

It is a small shrub, 2 m, with spreading branches. Alternately arranged leaves, 1-3 cm, are broadly elliptic, obtuse, with a rounded tip. Erect shrubs 0.5-3.5 m tall, glabrous throughout; branches slender. Shrubs or small tree having slender branches, small alternate leaves, monoecious flowers and globose, succulent fruit. Flowers are unisexual, in leaf axils, on filament-like peduncles. Male flowers 1-3 fascicled, yellow; female green; sepals 6, round; styles 3, divided into two. Fruits, 1-2 cm, are slightly flattened round berries, red, with much enlarged calyx which looks like a saucer.

1.20.3. Description
A graceful shrub with smooth, grey bark and spreading branches, found in forests of tropical Himalayas and in Deccan peninsula.

1.20.4. Medicinal Properties
The juice of stem of B. retusa is used in conjunctivitis. The leaves are used as a wrapping to speed up suppuration. The leaf juice is taken for body pain, skin inflammation, hyperglycemia, diarrhoea as well as diuretic, bark as astringent and diuretic. Its fruits have been used for dysentery, roots for fits and furthermore meningitis, twigs for toothache (Franco and Narasimhan, 2009).
1.21. WOODFORDIA FRUTICOSA KURZ. (FIRE-FLAME-BUSH)

1.21.1. Scientific Classification

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<tr>
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**Botanical Name**: Woodfordia fruticosa KURZ.

**Plant part used**: Flowers

**Found In**: Throughout India but abundantly found in north India upto 1600 m.

**Other names**: Fire-flame Bush, Shinajitea, Woodfordia

1.21.2. Introduction

*W. fruticosa* is a spreading, leafy shrub which is small in size but very conspicuous on dry. It is a deciduous shrub, usually with a much-fluted stem. The flowers contain much tannins, a red dye is obtained which is used to dye silks.

1.21.3. Description

*W. fruticosa* is found in waste land and degraded places. It is also growing naturally in dry areas. Each flower, borne on a tiny stem, is a slender tube, slightly curved, the greenish base of which is the sepal. The tube divides into narrow, pointed lobes and from within emerges a bunch of long stamens. The whole length, including the stamens, is about 1 to 2 cm. The fruit is a small, oblong capsule, covered by the withered sepals. The narrow, pointed leaves grow straight from the branches, either opposite or in whorls of three. They are harsh and dull, dark green in colour. The leaves also contain a large portion of tannin.

1.21.4. Chemical Constituents

It consists of tannin which is up to 20% in all parts of the tree.
1.21.5. MEDICINAL PROPERTIES

*W. fruticosa* is useful in the conditions of kapha as well as pitta, leprosy, burning sensation, skin diseases, diarrhoea, dysentery, fever, headache, hemorrhoids, herpes, internal hemorrhage, leukorrhea, liver disorders, menorrhagia, ulcers and wounds. The juice of the leaves are used in bilious sickness. They are also valued as a stimulant in pregnancy. Dried flower powder is used in ulcers and wounds to reduce the discharge and promote granulation. The juice of its fresh flowers applied on the forehead, reduces the headache.
Fig: 1.5. Plant of *Z. sativa*

Fig: 1.6. Plant of *R. hypocriteriformis*

Fig: 1.7. Plant of *B. retusa*

Fig: 1.8. Plant of *W. fruticosa*
1.22. *SOLANUM SURATTENSE* SCHRAC & WENDLE (BHAT-KATELI)

1.22.1. Scientific Classification

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</tr>
<tr>
<td>Species</td>
<td>surattense</td>
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<tr>
<td>Botanical Name</td>
<td><em>Solanum surattense</em> SCHRAC &amp; WENDLE</td>
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<tr>
<td>Plant part used</td>
<td>Seeds</td>
</tr>
<tr>
<td>Found In</td>
<td>Plains from the coast to 100m. India, Himalaya, south east Asia, Malaysia, Australia, Polynesia.</td>
</tr>
</tbody>
</table>

1.22.2. Introduction

A large genus including herbs, shrubs and rarely trees occurring throughout the world. *S. surattense* is perennial, very prickly diffused herb of wasteland much branched and spiny scandent shrubs. Leaves are deltoid or triangular, irregularly lobed. Flowers are purple or blue in cymes. The Berries are globose, red or scarlet. The genus includes important food plants, fodder crops and species useful in medicines.

1.22.3. Description

*S. surattense*, found in the plains from seashore to hills up to 1000 m high. It is a very prickly perennial herb with woody base. Stems are branched greatly and the younger ones are clothed with dense, stellate and tomentose hairs. Prickles are compressed straight, glabrous and shining, often 1 to 3 cm long. Leaves ovate or elliptic, sinuate or sub pinnatifid, obtuse or subacute, stellately hairy on both sides, armed on the midrib. Petiole is long, stellately hairy and prickly. Flowers are in cymes or some times reduced as solitary.
1.22.4. Chemical Constituents

The principal alkaloid is steroidal alkaloid i.e. solasodine. The alcohol extracts of the plant contains fatty as well as resinus substances. Solasonine is also present in fruits. The glycoalkaloid content of fruits collected from plants growing in Jammu and Kashmir was reported to be 3.5 % (total alkaloids: 1.1%). Seeds yield 19.3% of a greenish yellow, semi drying oil with a characteristic Odour. The unsaponifiable matter of fruits contains two sterols, one of which is carpesterol (Gupta and Dutta, 1936).

1.22.5. Medicinal Properties

*S. surattense* is employed in the treatment of dropsy. It is also used in cough, asthma, dyspnoea, fever, pleurisy, heart diseases, hoarseness of voice, calculus. Also used in Ayurvedic medicine for cough, asthma, chest pain and for flatulence, sore throat, and toothache. It has high concentration of solasodine, a starting material for the manufacture of cortisone and sex hormones. Its bitter fruits are used in Indian curries.

1.23. *CICHERIUM INTYBUS* L. (KASANI)

1.23.1. Scientific Classification

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<tr>
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<tr>
<td>Botanical Name</td>
<td><em>Cichorium intybus</em> L.</td>
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<tr>
<td>Plant part used</td>
<td>Seeds</td>
</tr>
<tr>
<td>Origin</td>
<td>Native to Eurasia</td>
</tr>
<tr>
<td>Other name</td>
<td>High mallow, Common chicory</td>
</tr>
</tbody>
</table>
1.23.2. Introduction

*C. intybus*, is a bushy perennial herbaceous plant with blue, lavender, or occasionally white flowers. Various varieties of this plant are cultivated for salad leaves, *chicons* or for roots which are baked, ground, and used as a coffee substitute and additive. It is also grown as a forage crop for livestock "Chicory" is also the common name in the US.

1.23.3. Description

*C. intybus* are cultivated at Roadsides, railroads, disturbed sites. It is also cultivated in waste grounds. At the time of flowering, chicory has a tough, grooved, and more or less hairy stem, from 30 to 100 cm (10 to 40 in) tall. The leaves are stalked, lanceolate and unlobed. The flower heads are 2 to 4 cm wide, and bright blue. It flowers grows from July until october. The achenes have no feathery hairs but do have toothed scales on top.

1.23.4. Chemical Constituents

Chemical constituents of *C. intybus* were recognized as alpha-amyrin, taraxerone, baurenyl acetate as well as beta-sitosterol (Du *et al.*, 1998). Inulooligosaccharides (IOS) production from chicory extract was approved out by means of endoinulinase which obtained from a new isolate, Xanthomonas oryzae No. 5 (Cho *et al.*, 2001). Twelve compounds were isolated from the root of *C. intybus* including 2, 3, 4, 9-tetrahydro-1H-pyrido-(3,4-b)indole-3-carboxylic acid (He *et al.*, 2002).

1.23.5. Medicinal Properties

*C. intybus* purify the blood and liver, while others have relied on the herb for its power to cure passions of the heart. Chicory is taken internally for loss of appetite, jaundice, gallstones, gout and rheumatism. The leaves of chicory may also be used as compresses to be applied externally to ease skin inflammations and swellings. It increases the elimination of fluid from the body, leading to its use as a treatment for rheumatism and gout. The root and the leaves are appetizer, cholagogue, depurative, digestive, diuretic, hypoglycaemic, laxative and tonic. It favours blood circulation by making blood more fluid and allowing it a better travel through vein and arteries.

1.24. *MALVA SYLVESTRIS L.* (HIGH MALLOW)

1.24.1. Scientific Classification

Kingdom : Plantae
**Division** : Magnoliophyta  
**Class** : Magnoliopsida  
**Order** : Malvales  
**Family** : Malvaceae  
**Genus** : Malva  
**Species** : Sylvestris  
**Botanical Name** : Malva sylvestris L.  
**Plant part used** : Seeds  
**Other names** : Tall mallow, Common mallow, High mallow, Blue mallow, Cheese-cake, Pick-cheese, Round dock, Country-mallow, Wild mallow, Wood mallow

### 1.24.2. Introduction

*M. sylvestris* has hairy stems and large lobed leaves, with mauve, five-petalled flowers with deeper lines on in the leaf axils. It has been used in traditional herbal medicine since Roman times, to treat kidney, bronchial and skin problems. The young leaves and shoots and unripe seed pods can all be eaten in salads or as a vegetable. They are annual, biennial or short-lived perennial herbs. The flowers are pink to purple to bluish, or white. The stems and foliage are typically downy or hairy. The fruits consist of a divided capsule containing a ring of nutlets.

The stems, which die down in the autumn, are erect, 3 to 4 feet high, simple, or putting out only a few lateral branches. The leaves, shortly petioled, are roundish, ovate-cordate, 2 to 3 inches long and about 1 1/4 inch broad, entire or three to five lobed, irregularly toothed at the margin, and thick. They are soft and velvety on both sides, due to a dense covering of stellate hairs. The flowers are shaped like those of the common Mallow, but are smaller and of a pale colour, and are either axillary, or in panicles, more often the latter. The stamens are united into a tube, the anthers, kidney-shaped and one-celled. The flowers are in bloom during August and September, and are followed, as in other species of this order, by the flat, round fruit called popularly 'cheeses'.

### 1.24.3. Description

Habitats include such disturbed areas as roadsides, vacant lots, edges of yards, and vacant. It is a native of most countries of Europe, from Denmark southward. It grows in salt
marshes, in damp meadows, by the sides of ditches, by the sea and on the banks of tidal rivers. The common mallow is a biennial or perennial, fairly much covered with simple or star-shaped hairs, with erect or supple branched stems 10-60cm. long. The leaves are simple, lengthwise petiolated, suborbicular-twisted. The flowers are single or in axillary fascicles, on unequal peduncles, shorter than the leaves. The flowers are pink to purple to bluish, or white.

1.24.4. Chemical Constituents

The fruits, seeds and extracts of *M. sylvestris* have been used for their content on phytochemicals. It contain diverse quantities of steroidal lactones, homomonoterpenic glucoside sylvestrosterol A, sylvestrosterol B sylvestrosterol C, malvanoyl glucoside, sylvestrogenin A, sylvestrogenin B, ferulic acid, scopoletin, Calcium, Magnesium, uronic acids, the main amino acids serine, alanine and hydroxyproline, polysaccharide, glucuronic acid, galacturonic acid, rhamnose and galactose (Classen and Blaschek, 2012).

1.24.5. Medicinal Properties

The great demulcent and emollient properties of marsh mallow make it useful in inflammation and irritation of the alimentary canal, and of the urinary and respiratory organs. When boiled in wine or milk, marsh mallow will relieve diseases of the chest, constituting a popular remedy for coughs, bronchitis, whooping-cough, etc. It is frequently given in the form of a syrup, which is best adapted to infants and children.
1.25. *ONOSMA BRACTEATUM* Wall. (SEDGE)

1.25.1. Scientific Classification

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<tr>
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1.25.2. Introduction

*O. Bracteatum* is a medium sized perennial herb. The stems are many, simple, hairy, arising from a persistent cluster of radical leaves, which are lanceolate and with conspicuous hairy pallid bases. A perennial roughly hairy herb, the dried leaves of which are used as the drug. The drug is used as a tonic, alterative, demulcent, diuretic and refrigerant; it is useful as a spasmolytic. The flowers are hermaphrodite (have both male and female organs) and are pollinated by Insects.

1.25.3. Description

It is found in the kumau area at the height of 11000 feet. It is also found on the hilly areas of Iran and Afghanistan. Found abundantly in Northwestern Himalayas from Kashmir up to 3,500 - 4,500 meters in height. It is a small shrub that attains a height of 15 inch and is hairy. Flowers are of purple color, soft and are of 2 to 3 inch in diameter. Fruits are 1/3 inch long, brown, sharp at the apex, and oval in shape. The stem is simple, hairy, arising from a cluster of radical leaves, which are lanceolate and with conspicuous hairy pallid bases. The leaves are with evident veins. The cauline leaves are lanceolate. The flowers are blue or purple, trumpet-shaped, in dense, silky, glomaerate clusters.

1.25.4. Chemical Constituents
Its leaves contain all slimy substance. Besides this it contains sodium 9.5 %, Potassium 14.25 %, Calcium 27 %, Iron 1 % and Magnesium.

1.25.5. Medicinal Properties

It is used in rheumatism, alterative, diuretic, syphilis, leprosy and heart diseases. It is also used in excessive thirst and restlessness, in febrile excitement, irritation of bladder and stomach. It is also used for dandruff and for hair treatment. The root is purgative, anti-inflammatory i.e. particularly used in rheumatic and paralytic affections, also in fevers, oedema, hepatic and haemophilic diseases. Its fern is antiseptic, styptic, vulnerary and detergent. An ointment, prepared by boiling the herb in oil or fat, is used for wounds.
1.26. *CITRULLUS COLOCYNTHIS* (L.) Schrad. (BITTER CUCUMBER)

1.26.1. Scientific Classification

<table>
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</tr>
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<td>Plant part used</td>
<td>Fruit</td>
</tr>
<tr>
<td>Found In</td>
<td>Wadi beds in dry hot places, Jordan Valley, Dead Sea, Wadi Araba, Aqaba, Wadi Rum and Eastern Desert.</td>
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<td>Other names</td>
<td>Colocynth, Bitter apple, Egusi, or Vine of Sodom.</td>
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</table>

1.26.2. Introduction

The colocynth, also known as bitter apple, bitter cucumber, egusi, or vine of Sodom is a viny plant. It originally bore the scientific name *Colocynthis citrullus*, but is now classified as *C. colocynthis*. Its fruit, which is lemon-sized, yellowish, green-mottled, spongy, and extremely bitter, is a powerful hepatic stimulant. It is used as a strong laxative. The Colocynth collected from the Maritime Plain between the mountains of Palestine and the Mediterranean, is mainly shipped from Jaffa and known as Turkish Colocynth. It is an annual plant resembling the common watermelon.

1.26.3. Description

It is found in warmer climate and tropical areas like that of Africa, especially in the region of Nubian. It is also seen in southern part of Asia including India, Pakistan and southern islands. This tree is native of dry areas around Africa and turkey. It is easily found in desert areas of Sahara and in the Mediterranean region.

It is a perennial herbaceous vine that has rough and an angular stem having rough hairs. Leaves are alternately arranged on the petioles. Leaves are rough to touch and are about 6 to 10 cm long. Flower is yellow and is seen on the axils of the leaves. It is monoecious, single and pedunculated. Fruits are globular with yellow colour and smooth texture. It is hard
and has a rind around it. It is about 4 to 10 cm in diameter and it contains large number of seeds in it which are ovoid, compressed and smooth.

1.26.4. Chemical Constituents

The seeds of *C. colocynthis* are affluent in fatty acids such as myristic, palmitic, stearic, oleic, linoleic and linolenic acid. The seed oil from is edible, its composition is comparable to that of soyabean oil. Refining and washing it with citric acid removes its bitter taste (Ramakrishna *et al.*, 1993). The protein content of seeds be found to be 8.25 % and prosperous in lysine, leucine and sulfo-amino acids i.e. methionine (Shaheen and Hamed, 2003).

1.26.5. Medicinal Properties

It is mainly used in the healing of tumours, ulcers and cancerous growth as its main function is scrapping out the extra tissues. It is also used in constipation as it is a strong purgative. Colocynth is used for amenorrhea, ascites, bilious disorders, fever, jaundice, leukemia, rheumatism, snakebite and urogenital disorder.

1.27.  *DATURA INOXIA* Mill. (DATURA)

1.27.1. Scientific Classification

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<td><em>Datura</em></td>
</tr>
<tr>
<td>Species</td>
<td><em>inoxia</em></td>
</tr>
<tr>
<td>Botanical Name</td>
<td><em>Datura inoxia</em> Mill.</td>
</tr>
<tr>
<td>Plant part used</td>
<td>Fruit &amp; Seeds</td>
</tr>
<tr>
<td>Found In</td>
<td>Temperate and Tropical regions worldwide</td>
</tr>
<tr>
<td>Other names</td>
<td>Jimsonweed, Metel nut, Thorn Apple</td>
</tr>
</tbody>
</table>

1.27.2. Introduction

*D. inoxia* is a species in the family Solanaceae. The plant was first described in 1768 by English botanist Philip Miller, who spelled it *D. inoxia*. It is an annual plant, blooming June-November. Stems are grey, hairy and spreading. Leaves are alternate, soft, hairy, ovate forming a sharp point, ten inches long and have an unpleasant scent. Margins can be wavy or
entire. Flowers are solitary, upward facing, eight inches long, tube-shaped, pink, purple or white, frilly and five-lobed; flowering June, July, August, and September to frost. Fruits are nodding, round, hairy, spiny capsules with many black, kidney-shaped seeds and with poisonous seeds. All parts of this plant are poisonous and contain Atropine, hyoscine, and hyoscyamine.

1.27.3. Description

*D. inoxia* is an annual shrubby plant that typically reaches a height of 0.6 to 1.5 metres. Its stems and leaves are covered with short and soft greyish hairs, giving the whole plant a greyish appearance. It has elliptic entire-edged leaves with pinnate venation. All parts of the plant emit a foul odour similar to rancid peanut butter when crushed or bruised. The flowers are white, trumpet-shaped, 12–19 cm long. They first grow upright, and later incline downward. Its flowers from early summer until late fall. The fruit is an egg-shaped spiny capsule, about 5 cm in diameter. It splits open when ripe, dispersing the seeds. The seeds have hibernation capabilities, and can last for years in the soil.

1.27.4. Chemical Constituents

The phytochemical in addition to proximate analyses of *D. inoxia* leaf, seed, stem, pod and root revealed the presence of atropine, scopolamine. The contiguous analysis indicated the significant (P < 0.05) variation in crude protein content which ranged from 2.09 in the root to 17.21%, moisture content (3.5 in roots to 15% in stem), crude lipid content was 6% in root and 15.52% in the seed. The Total ash was highest in the root (25.71%) and least in the seed (8.26%) while nitrogen free extract was (47.97%) and 20.88% in the pod and stem, respectively (Ayuba et al., 2011).

1.27.5. Medicinal Properties

The plant has been used to treat impotence, asthma, diarrhea, as an analgesic, to control fever. It is used as a pain-killer.

1.28. **Ricinus Communis L. (Castor)**

1.28.1. Scientific Classification

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division</td>
<td>Magnoliophyta</td>
</tr>
<tr>
<td>Class</td>
<td>Magnoliopsida</td>
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</tbody>
</table>
Order : Malpghiales
Family : Euphorbiaceae
Genus : Ricinus
Species : communis
Botanical Name : *Ricinus communis* L.
Habitat : Common in distributed areas and waste land
Plant part used : Castor Leaves, Castor Seeds, Castor Roots, Castor Oil.
Other names : Castor, Palma Christi, Ricin, Wonder Tree, Krapata, Djarak, Reer

1.28.2. Introduction

The Castor oil plant, *R. communis*, is a species of flowering plant in the spurge family, Euphorbiaceae. It belongs to a monotypic genus, *Ricinus* and subtribe, Ricininae. Its seed is also known as the castor bean. Castor is indigenous to the southeastern Mediterranean Basin, Eastern Africa, and India, but is widespread throughout tropical regions and widely grown elsewhere as an ornamental plant. Castor seed is the source of castor oil, which has a wide variety of uses. The seeds contain between 40% and 60% oil that is rich in triglycerides, mainly ricinolein. The seed contains ricin, a toxin, which is also present in lower concentrations throughout the plant. Its flower appears from July to September, and the seeds ripen from September to November. The flowers are monoecious (individual flowers are either male or female, but both sexes can be found on the same plant) and are pollinated by Wind. The plant is self-fertile. The plant prefers light (sandy), medium (loamy) and heavy (clay) soils, requires well-drained soil as well as can grow in heavy clay soil. The plant prefers acid, neutral and basic (alkaline) soils. It cannot grow in the shade. It requires moist soil.

1.28.3. Description

*R. communis* is a fast-growing, suckering perennial shrub which can reach the size of around 12 metres / 39 feet. The glossy leaves are 15–45 centimetres long, long-stalked, alternate and palmate with 5–12 deep lobes with roughly toothed segments. In some varieties they start off dark reddish purple or bronze when young, gradually changing to a dark green, sometimes with a reddish tinge, as they mature. The stems also vary in pigmentation. The fruit capsules of some varieties are showier than the flowers. The flowers are borne in terminal panicle-like inflorescences of green, in some varieties in which the male flowers are
yellowish-green with prominent creamy stamens and are carried in ovoid spikes up to 15 centimetres long whereas the female flowers born at the tips of the spikes and have prominent red stigmas. It is also used extensively as a decorative plant particularly as a “dot plant”, it can grow well outdoors in cooler climates.

1.28.4. Chemical Constituents

The physicochemical characteristic of *R. communis* contain a relatively high percentage of total lipids content; 43.3%, high iodine value (84.5 mg/g) and saponification value (182.96 mg/g). The seed oil moisture content, acid value as well as free fatty acid percentage (% FFA) were 0.2%, 4.88 mg/g and 3.4%, respectively. The unsaturated fatty acids (UFA) content were 97.5% of the total fatty acids composition. Ricinoleic acid comprises over 84% while other fatty acids present were linoleic (7.3%), oleic (5.5%), palmitic (1.3%), stearic (1.2%) and linolenic (0.5%), respectively (Salimon et al., 2010).

1.28.5 Medicinal Properties

Externally, it is effectively used in the pain and swellings. The seed oil massage with its hot leaves relieves diseases like arthritis, sciatica, rheumatism, gout, mastitis and skin diseases. Its oil also acts as a cleansing agent for the eyes. It cleans the eyes and facilitates the removal of any foreign bodies in the eye. Hepatitis can be effectively treated with the fresh juice of its leaves and sugar. Its oil relieves constipation and effective in treating piles. It is also beneficial in cough, colds and asthma. Castor bean is cultivated for the seeds which yield fast-drying, non-yellowing oil, used mainly in industry and medicines. The oil is also used in coating fabrics and other protective coverings, in the manufacture of high-grade lubricants, transparent typewriter and printing inks, in textile dyeing, in leather preservation, and in the production of 'Rilson', a polyamide nylon-type fiber. Dehydrated oil is an excellent drying agent which is used in paints and varnishes. Hydrogenated oil is utilized in the manufacturing of waxes, polishes, carbon paper, candles and crayons. Castor Oil pomace, the residue after crushing is also used as a high-nitrogen fertilizer. Although it is highly toxic due to the ricin, a method of detoxicating the meal and it can safely be fed to livestock. Stems are made into paper and wallboard.

1.29. *QUERCUS INFECTORIA* L. (MAJUPHAL)

1.29.1. Scientific Classification

Kingdom : Plantae
1.29.2. Introduction

*Q. infectoria* is a small tree or shrub with glabrescent leaves, with spiny teeth. This oak tree prefers partial shade or partial sun to full sun, and requires moist soil. The gall nuts are produced by insects of the genes chiefly with the Quercus infector oak of western Asia and Southern Europe.

1.17.3. Description

This species is most abundant in Asia Minor, and extends to middle Asia. A small tree from four to six feet high, crooked and shrubby-looking, with smooth and bright-green leaves.

1.17.4. Chemical Constituents

The gall nuts of commerce are produced by insects of the genes (Cynips) chiefly with the plant oak of western Asia and Southern Europe. The galls contain tannic acid (gallo-tannic acid) as the principal constituent (50-70%). The tannic and Gallic acids extracted from the galls are often used in dysentery and diarrhea. They are a powerful astringent, used to check diarrhea.

1.17.5. Medicinal Properties

The bark is considered as astringent and used for treating nose bleeding, certain chronic skin diseases including eczema, impetigo and vitiligo. Seeds are used as a food flavouring agent, usually dry seeds are powdered and added into stews, breads and cereals. The galls are rich in tannins and also have anti-viral and anti-septic. They are used in treating
pharyngitis, diarrhea, dysentery, hemorrhoids, gonorrhea, virginal infections, including leucorrhea. Galls are purely and powerfully astringent, scarcely stimulant. They may be used as a wash and gargle in aphthous sores.
1.30. **LINUM USITATISSIMUM L. (LINSEED)**

### 1.30.1. Scientific Classification

<table>
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<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
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<tbody>
<tr>
<td>Division</td>
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<td>Family</td>
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<tr>
<td>Genus</td>
<td><em>Linum</em></td>
</tr>
<tr>
<td>Species</td>
<td><em>usitatissimum</em></td>
</tr>
<tr>
<td>Botanical Name</td>
<td><em>Linum usitatissimum</em> L.</td>
</tr>
<tr>
<td>Popular Name(s)</td>
<td>Flax seed</td>
</tr>
<tr>
<td>Habitat</td>
<td>Cultivated throughout India.</td>
</tr>
<tr>
<td>Plant Part Used</td>
<td>Seeds</td>
</tr>
</tbody>
</table>

### 1.30.2. Introduction

Flax is an erect annual plant growing to 1.2 m (3 ft. 11 inch) tall, with slender stems. The leaves are glaucous green, slender lanceolate, 20–40 mm long and 3 mm broad. The flowers are pure pale blue, 15–25 mm diameter with five petals; they can also be bright red. The fruit is a round, dry capsule 5–9 mm diameter, containing several glossy brown seeds shaped like an apple pie, 4–7 mm long.

### 1.30.3. Description

Flax seeds, as the name suggests, are the seeds of flax plant, which is a member of the genus *Linum* in the family Linaceae. They are known for producing a vegetable oil known as linseed oil or flaxseed oil.

It is one of the oldest commercial oils. In fact, the solvent-processed flax seed oil has been used as a drying oil in painting and varnishing, for centuries. Flax seeds are edible and suitable for human consumption. They are also one of the most concentrated plant sources of the omega-3 alpha-linolenic acid. These seeds come in two basic varieties - brown and yellow.

Flax seeds come in two basic varieties i.e. brown and yellow or golden. Flax seed sprouts are edible, with a slightly spicy flavour. Excessive consumption of flax seeds with
inadequate water can cause bowel obstruction. Flaxseed is called 'Tisi' in northern India, particularly in the Bihar region. Roasted 'Tisi' is powdered and eaten with boiled rice, a little water, and a little salt since ancient times in the villages. They are chemically stable while whole, and milled flax seed can be stored at least 4 months at room temperature with minimal or no changes in taste, smell, or chemical markers of rancidity, which can start with its seed coat becoming bitter. Ground flaxseed can go rancid at room temperature in as little as one week (Alpers et al., 1996). Ground flax is remarkably stable to oxidation when stored for 9 months at room temperature (Pan et al., 2009) and for 20 months at ambient temperatures under warehouse conditions (Chen et al., 1994).

1.30.4. Chemical Constituents

Flax contains fat, protein, dietary fiber, omega-3 fatty acids, moisture, phenolic acids, flavonoids, lignans and ash. The chemical composition of flax can vary, owing to certain factors such as genetics, growing environment and seed processing. As the oil content increases, the protein content of the seed decreases.

1.30.5. Medicinal Properties

The Flax seeds improve digestion, helps in stabilizing blood glucose levels, fight tumour formation as well as to enhance cardiovascular health. Flax contains anti-inflammatory properties as such it helps to reduce inflammation in conditions such as asthma, osteoarthritis, rheumatoid arthritis, migraine headaches, and osteoporosis. Consumption of flax also promotes bone health, due to the presence of Omega-3 fatty acids.

Flax seeds protect us against heart diseases, by reducing the formation of blood clots. They are also effective in fighting cancer and diabetes and reduce the risk of colon cancer by protecting colon cells from cancer causing toxins and free radicals. It is an excellent source of omega-3 fatty polyunsaturated fatty acids, which help to lower blood pressure, in effect preventing and controlling high blood pressure. Crushed flax seed is used in the treatment of severe cases of chronic constipation (usually mixed into breakfast cereals and taken with lots of liquid), gastritis and enteritis. Flax seed can be used as a dietary supplement to help treat eczema, menstrual problems, hardening of the arteries and the oil for rheumatoid arthritis. Flaxseed oil is extracted by cold pressing the seeds and is high in essential fatty acids. While taking it internally can reduce the pain, swelling, inflammation and discomfort of arthritis, as well as reducing cholesterol and triglyceride levels. Flaxseed is added to breads and also used
as a coffee substitute. Although it does not produce an "essential oil" as the oil extracted from the seeds is a "fixed" oil - it can however be used as a carrier oil in aromatherapy.

1.31. **SOLANUM NIGRUM** L. (MAKOY)

1.31.1. Scientific Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Category</th>
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<tr>
<td>Genus</td>
<td>Solanum</td>
</tr>
<tr>
<td>Species</td>
<td>nigrum</td>
</tr>
</tbody>
</table>

**Botanical Name**: Solanum nigrum L.

**Plant part used**: Fruits, Whole plant

**Popular Names**: Deadly Nightshade, Garden Nightshade, Kakamachi

1.31.2. Introduction

Black nightshade is a fairly common herb or short-lived perennial shrub, found in many wooded areas, as well as disturbed habitats. It has a height of 30–120 cm, leaves 4–7.5 cm and 2–5 cm wide, ovate to heart-shaped, with wavy or large-toothed edges, both surfaces hairy or hairless; petiole 1–3 cm long with a winged upper portion. The flowers have petals greenish to whitish, recurved when aged and surround prominent bright yellow anthers. The berry is mostly 6–8 mm in diameter, dull black or purple-black. In India, another strain is found with berries that turn red when ripe (Venkateswarlu and Krishna, 1971) The Black Nightshade is an annual plant, common and generally distributed in the South of England, less abundant in the North and somewhat infrequent in Scotland. It is one of the most cosmopolitan of wild plants, extending almost over the whole globe. It is frequently to be seen by the wayside and is often found on rubbish heaps, but also among growing crops and in damp and shady places. It is sometimes called the Garden Nightshade, because it so often occurs in cultivated ground.

1.31.3. Description

It rarely grows more than a foot or so in height and is much branched, generally making a bushy-looking mass. It varies much according to the conditions of its growth, both
as to the amount of its dull green foliage and the size of its individual leaves which are egg-shaped and stalked and the outlines are bluntly notched or waved. The stem is green and hollow. The flowers are arranged in clusters at the end of stalks springing from the main stems at the intervals between the leaves not, as in the Bittersweet, opposite the leaves. They are small and white, resembling those of Bittersweet in form, and are succeeded by small round berries, green at first, but black when ripe. The plant flowers, fruits freely and the masses of black berries have a very polished surface when matured.

The fruits are used as a tonic, laxative, appetite stimulant; and also for treating asthma and "excessive thirst" (Jain, 1968). Traditionally this plant was used to cure tuberculosis (Kaushik et al., 2009). This plants leaves are used to treat mouth ulcers. In North India, the boiled extracts of leaves and berries are also used to alleviate liver-related ailments, including jaundice. In Assam, the juice from its roots is used against asthma and whooping cough (Sikdar and Dutta, 2008).

1.31.4. Chemical Constituents

It contains a toxin named solanine ($C_{45}H_{73}O_{15}$). Solanine is a mixture of two classes of glycosides, solanine and chaconines. These compounds contain the same basic alkamine aglycone, solanidine, but differ with respect to the composition of the sugar chain. Alpha-solanine is the main constituent. Solanine is found throughout the plant, with the highest concentrations in the unripened berries. The concentration of solanine increases in the leaves as the plant matures (Cooper & Johnson, 1984).

1.31.5. Medicinal Properties

The leaves of black nightshade are popularly used as a vegetable. The juice of the leaves can be mixed with medium like coconut water, coconut milk, buttermilk, cow's milk and fruit juice and are effective in the treatment of digestive disorders. The raw juice of the leaves can be used alone or mixed with other juices or liquids. It is used in stomach disorders like flatulence, colitis and peptic ulcers. A mixture of the plant is useful in dysentery and other stomach ailments. It is useful in the treatment of dropsy. It increases the secretion and discharge of urine. Either it can be used as decoction or as a vegetable in the treatment of this disease. The leaves of black nightshade are useful in fevers. Syrup of the vegetable can be given as a cooling drink.

The plant is beneficial in chronic skin diseases. The juice can also be applied locally on the affected parts in chronic skin disease such as acne, eczema and psoriasis. As an
anodyne or pain reliever, a decoction of the plant can be used for washing inflamed, irritated and painful parts can be used for washing inflamed, irritated and painful parts of the body. The paste of black nightshade serves as a useful applicant over ulcers, severe burns, herpes and rheumatic joints. Green fruits of the plant can be ground and applied locally on ringworms. A juice or poultice of leaves can be effectively applied on eruptive skin diseases and burns. Hot leaves can be applied over swollen and painful scrotum and testicles.

1.32. **CURCUMA LONGA L. (TURMERIC)**

1.32.1. **Scientific Classification**

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<tr>
<th>Kingdom</th>
<th>Plantae</th>
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</thead>
<tbody>
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<tr>
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<td>Curcuma longa L.</td>
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<tr>
<td>Plant part used</td>
<td>Rhizome</td>
</tr>
<tr>
<td>Found In</td>
<td>Sanjay Gandhi National Park</td>
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<tr>
<td>Other name</td>
<td>Kunyit, Haridra, Haldi, Halada, Manjal, Zirsood, terremerite, Holdi, Indian Saffron.</td>
</tr>
</tbody>
</table>

1.32.2. **Introduction**

*C. longa*, a perennial herb, is a member of the Zingiberaceae (ginger) family. The plant grows to a height of three to five feet, and is cultivated extensively in Asia, India, China, and other countries with a tropical climate. It has oblong, pointed leaves and bears funnel-shaped yellow flowers (Dobelis *et al.*, 1986).

The rhizome is the portion of the plant which is used medicinally; it is usually boiled, cleaned, and dried, yielding a yellow powder. Dried *C. longa* is the source of the spice turmeric, the ingredient that gives curry powder its characteristic yellow colour. Turmeric is used extensively in foods for both of its flavour and colour. Turmeric has a long tradition of use in the Chinese and Ayurvedic systems of medicine, particularly as an anti-inflammatory agent, and for the treatment of flatulence, jaundice, menstrual difficulties, hematuria,
hemorrhage, and colic. Turmeric can also be applied topically to relieve pain and inflammation (Leung, 1980).

1.32.3. Description

It is a perennial plant with roots or tubers oblong-palmate, as well as deep orange inside. The Leaves are about 2 feet long, lanceolate, long, petioled, tapering at each end, smooth, of a uniform green. The flowers are dull yellow and three or five together surrounded by bracteolae. It is propagated by cuttings from the root. When in fresh state, the roots have an aromatic and spicy fragrance, which by drying gives way to a more medicinal aroma.

1.32.4. Chemical Constituents

The active constituents of turmeric are the flavonoid curcumin and volatile oils including tumerone, atlantone, and zingiberone. Other constituents include sugars, proteins, and resins. The best-researched active constituent is curcumin, which comprises 0.3 to 5.4 percent of raw turmeric. Pharmacokinetic studies in animals demonstrate that 40-85 percent of an oral dose of curcumin passes through the gastrointestinal tract unchanged, with most of the absorbed flavonoid being metabolized in the intestinal mucosa and liver (Ravindranath and Chandrasekhara, 1980; Wahlstrom and Blennow, 1978). Due to its low rate of absorption, curcumin is often formulated with bromelain for increased absorption and enhanced anti-inflammatory effect.

1.32.5. Medicinal Properties

It is a bitter herb with a pungent smell with astringent, anti-biotic, anti-inflammatory and anticoagulant properties. It is used to stimulate the uterus, digestive, respiratory and circulatory systems, normalizes energy flow and lowers cholesterol levels. It has anti-inflammatory, antioxidative, antimicrobial and cytotoxic (fights tumors) properties.

It is taken as the blood purifier and is very useful in the common cold, leprosy, intermittent, affections of the liver, dropsy, inflammation and wound healing. The rhizome of the turmeric plant is highly aromatic and antiseptic. It is even used for contraception, swelling, insect stings, wounds, whooping cough, inflammation, internal injuries, pimples, injuries, as a skin tonic. Sweetened milk boiled with the turmeric is the popular remedy for cold and cough. It is given in liver ailments and jaundice.
This herb can be used internally to help out with digestive problems and skin complaints, circulatory disorders as well as tumours in the uterus and menstrual problems. Furthermore it is used to treat liver disease and jaundice, as well as colon cancer. It is also used as an anti-inflammatory for asthma and eczema, and to reduce the risk of stroke and heart attacks. In Chinese medicine it is used to stimulate the Qi (life force) and for chest, stomach and period pain, removing stagnation, lifting both depression and mania, while relaxing the gall bladder and to treat jaundice and gall stones. In Ayurvedic medicine it is used for stomach problems and as a general tonic. It has good antioxidant and anti-cancer properties, protecting DNA, and also helps to protect against cigarette smoke condensation. This herb is also widely used in cooking since it imparts a bright yellow colour (from the curcumin pigment) and is an essential ingredient of curry. It is used externally for injuries and minor wound management, sores, ringworm, as well as athletes' foot. The powered rhizome of this plant is used as a condiment and as a yellow dye. It is used to colour and flavour the foodstuff. It is used in the preparation of medicinal oils, ointments and poultice. It is even used in the cosmetics.
1.33. **ACORUS CALAMUS** L. (VASA)

1.33.1. Scientific Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingdom</td>
<td>Plantae</td>
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<td>Division</td>
<td>Magnoliophyta</td>
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<tr>
<td>Plant Part Used</td>
<td>Dried Rhizome</td>
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<td>Popular Name(s)</td>
<td>Sweet flag, Sweet Root, Bach</td>
</tr>
<tr>
<td>Habitat</td>
<td>North Temperate and subtropical regions up to 2200m altitudes in Himalayas</td>
</tr>
<tr>
<td>Other Names</td>
<td>Calamus root, flag root, muskrat root, sweet calomel, sweet flag, sweet sedge.</td>
</tr>
</tbody>
</table>

1.33.2. Introduction

*A. calamus* is the botanical name of the plant more commonly known as calamus. It has long been classified as it belongs to the Araceae family, but now considers calamus to be a member of the Acoraceae family. The Acoraceae family is comprised of a single genus called Acorus. Only *A. calamus* and no more than one or two other species of Acorus are included in the genus. Both the leaves and rhizome are apparently psychoactive, with the rhizome being more potent.

1.33.3. Description

The plant has a branched and aromatic root or rhizome (underground horizontal stem of a plant that produces roots) from which rise its long erect leaves. The roots have a sweet fragrance which has been used to flavor candy as well as the leaves are sword-like and smell is similar to lemon. The flowers eventually give way to small berries. It is found in both temperate and sub-tropical areas of the globe. The sheathing leaves of this perennial are from 2 to 6 feet in height and about 1 inch in width. They are sharp pointed and have a ridged midrib running their entire length. The leaves of the blue flag (also called poison flag) are very similar to those of this plant. However, rhizomes of blue flag can be dangerously toxic.
The leaves of *A. calamus* are fragrant. The odor is aromatic and agreeable, and taste pungent and bitter.

### 1.3.3.4. Chemical Constituents

The main chemical components of *A. calamus* are Hydrocarbon (C$_{10}$H$_{16}$), Acorin (C$_{36}$H$_{60}$O$_6$), Trimethylamine (C$_3$H$_9$N), Asarone (C$_{12}$H$_{16}$O$_3$), acorenone, beta-asarone, calamendiol, a-selinene, a-calacorene, calamusenone, camphone and shyobunone. Four types of *A. calamus* have been characterized: diploid (North America), triploid (Europe), tetraploid (East Asia, India and Japan) and hexaploid (Kashmir).

### 1.3.3.5. Medicinal Properties

The oil of *A. calamus* is used as an ingredient in flavors particularly in liquors. It is used in the making of alcoholic drinks and in perfume to give a bitter tang to the former and those special nuances to the perfumes; it is also used in toothpaste. The rootstalks were at one time used to make candy. *A. calamus* root has a long history of medicinal usage. It is known as an old folk remedy for the treatment of arthritis, neuralgia, diarrhea, dyspepsia, hair loss and other disorders. It was well known for its medicinal value. Although the preparation of this species and the ailments treats vary rather among the tribes, rhizomes are the most commonly used part. It is used for the stomach and bowel because it stimulates the salivary glands and production of stomach juices, helping to counter acidity and ease heartburn and dyspepsia. In traditional Chinese medicine sweet flag is used to treat deafness, dizziness and epilepsy.

In Ayurvedic medicine this is an important herb, and is valued as a rejuvenator for the brain and nervous system, and as a remedy for digestive disorders. In Western herbal medicine the herb is chiefly employed for digestive problems such as gas, bloating, colic, and poor digestive function. *A. calamus* extract is anti-rheumatic and analgesic. The extract is used in the form of powder and balms and it is very much useful in case of asthma, bronchitis and cough. As per Indian Ayurveda it was used as an anesthetic for toothache and headaches.