1. Introduction to Medicinal plants.

1.1. Introduction

Plants have been used for medicinal purposes long before recorded history. Primitive men observed and appreciated the great diversity of plants available to them. Plants provide food, clothing, shelter, and medicine. Much of the medicinal use of plants seems to be developed through observations of wild animals, and by trial and error. As time went on, each tribe added the medicinal power of herbs in their area to its knowledge base. They methodically collected information on herbs and developed well-defined herbal pharmacopoeias.\textsuperscript{1-2}

Many drugs listed as conventional medications were originally derived from plants. Salicylic acid, a precursor of aspirin, was originally derived from white willow bark and the meadowsweet plant. Cinchona bark is the source of malaria-fighting quinine. The opium poppy yields morphine, codeine and paregoric, a remedy for diarrhoea. Laudanum, a tincture of the opium poppy, was the favoured tranquilizer in Victorian times. Even today, morphine the most important alkaloid of the opium poppy remains the standard against which new synthetic pain relievers is measured.\textsuperscript{3} Similarly, tetrahydrocannabinol (THC), the component of \textit{Cannibas sativa} responsible for the CNS effect, has also been found to reduce nausea associated with cancer chemotherapy. Another therapeutic area where natural products have had a major impact on longevity and quality of life is in the treatment of cancer. In fact, most of the major anticancer drugs are natural products either from plants or micro-organisms. Examples include important anticancer drugs such as Bleomycin, Doxorubicin, Vincristine, Vinblastine, and now the recent addition of Paclitaxel (Taxol), Ironotecan (a camptothecin derivative) and Etoposide and Tenoposide (Podophyllotoxin derivatives).

Some of the most exciting natural products discovered in the recent years are the cholesterol-lowering agents derived from fungi.
1. Introduction to Medicinal plants.

(These drugs act by inhibition of 3-hydroxy-3-methylglutaryl coenzyme A reductase (HMG-COA reductase), an enzyme in the biosynthesis of cholesterol). The first of the HMG-COA reductase inhibitors were isolated from Pencillium sp. Substances derived from the plants remain the basis for a large proportion of the commercial medications used today for the treatment of heart diseases, high blood pressure, pain, asthma, cancer and other problems. Plants contain a number of metabolites, as shown in the Table no-1.1.1 (a), only a small percentage has been investigated phytochemically and some fractions of them have been submitted for biological screening. The process of evaluation of plants for various pharmacological activities is a much time consuming process. So also is the process of isolation of active components present in the plants. Hence, it requires multi-disciplinary collaboration. Natural products have proven to be the richest source of medicinal compounds. Screening the marine flora and fauna, soil samples, fungi and microbes is conducted either to discover a new drug or a lead structure. A lead is a prototype compound for a given biological activity. For example for anti-tumour activity, a natural product lead structure is subjected to chemical modification or scaffolds to arrive at the therapeutically important molecular fragment, the pharmacophore. Only a few natural products are directly used as drugs, but in many cases the chemical scaffolds of the lead structure give a more potent synthetic or semi-synthetic analogs.

Globally, there has been an unparalleled growth in the plant-derived medicinally useful formulations, drugs and health-care products. It has a market covering more than 60% products derived from plant origin. India exhibits remarkable outlook in modern medicines that are based on natural products besides traditional system of Indian medicines. Almost, 70% of the modern medicines in India are derived from natural products.
1. Introduction to Medicinal plants.

Table No-1.1.1(a) presents some of the clinically very important natural product drugs, scaffolds structures, synthetic or semi-synthetic analogs.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Drugs from herbs and plants</th>
<th>Source</th>
<th>Therapeutic activity</th>
<th>Synthetic or semi-synthetic analogs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Atropine</td>
<td><em>Atropa belladonna</em></td>
<td>Antimuscarinics</td>
<td>Dicyclomine Hcl, Hyoscinebutylbromide</td>
</tr>
<tr>
<td>2</td>
<td>Benzyl penicillin</td>
<td><em>Penicillin chrysogenum</em></td>
<td>Antibiotic</td>
<td>Ampicillin, amoxycillin.</td>
</tr>
<tr>
<td>3</td>
<td>Codeine</td>
<td><em>Papaver somniferum</em></td>
<td>Analgesic</td>
<td>Nalaphine, meperidine.</td>
</tr>
<tr>
<td>4</td>
<td>Camptothecin</td>
<td><em>Camptotheca acumrnata</em></td>
<td>Anticancer</td>
<td>10-hydroxy camptothecin, aminocamptothecin, topotecan, ironotecan.</td>
</tr>
<tr>
<td>5</td>
<td>Digoxin</td>
<td><em>Digitalis lantana</em></td>
<td>Cardiovascular</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Ephedrine</td>
<td><em>Ephedra vulgaris</em></td>
<td>Anti-asthma</td>
<td>Salbutamol, salmeterol.</td>
</tr>
<tr>
<td>7</td>
<td>Lovastatin</td>
<td><em>Aspergillus terrus</em></td>
<td>Hypercholesterolemia</td>
<td>Pravastatin.</td>
</tr>
</tbody>
</table>
### 1. Introduction to Medicinal plants.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Drugs from herbs and plants</th>
<th>Source</th>
<th>Therapeutic activity</th>
<th>Synthetic or semi-synthetic analogs</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Morphine</td>
<td><em>Papaver somniferum</em></td>
<td>Analgesic</td>
<td>Heroine, naloxane, phthadine</td>
</tr>
<tr>
<td>9</td>
<td>Podophyllotoxin</td>
<td><em>Podophillum pettatum</em></td>
<td>Anticancer</td>
<td>Etopside, toniposide.</td>
</tr>
<tr>
<td>10</td>
<td>Quinine</td>
<td><em>Cinchona succirubra</em></td>
<td>Anti-malarial</td>
<td>Chloroquine, meploquinine, pamaquine, premaquine.</td>
</tr>
<tr>
<td>11</td>
<td>Reserpine</td>
<td><em>Rawolfia serpentina</em></td>
<td>Hypotension and Anticholinergic</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>Tubacurarine</td>
<td><em>Tube curare</em></td>
<td>Neuro-muscular blocking agent</td>
<td>Decamethoxium, soxamethorium.</td>
</tr>
<tr>
<td>13</td>
<td>Taxol</td>
<td><em>Taxus baccata</em></td>
<td>Anticancer</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>Teprotide</td>
<td><em>Bathrops javaraca</em></td>
<td>Antihypertensive</td>
<td>Captopril, enalapril, lisinopril</td>
</tr>
<tr>
<td>15</td>
<td>Vinblastin, Vincristine</td>
<td><em>Cathranthus roseus</em></td>
<td>Anticancer</td>
<td>Vindesine.</td>
</tr>
</tbody>
</table>
1. Introduction to Medicinal plants.

Medicinal plants play a central role not only as traditional medicines but also as trade commodities, meeting the demand of distant markets. Ironically, India has a very small share (1.6%) of this ever-growing global market.

To compete with the growing market, there is urgency to expeditiously utilize and scientifically validate more medicinally useful plants while conserving these species, which seems a difficult task ahead.\(^8\)

1.1.1. Medicinal and Aromatic Plants

India has 2.4% of world’s area with 8% of global bio-diversity. It is one of the 12 mega-diversity hot-spot regions of the world. Other countries being Brazil, Colombia, China, South Africa, Mexico, Venezuela, Indonesia, Ecuador, Peru, USA and Bolivia. Across the country, the forests of India are estimated to harbour 90% of India’s medicinal plants diversity. Only about 10% of the known medicinal plants of India are restricted to non-forest habitats. The estimated numbers of plant species and those used for medicinal purpose vary. According to (Schippmann, 2002),\(^9\) one fifth of all the plants found in India are used for medicinal purpose. The world average stands at 12.5% while India has 20% plant species of medicinal value.

But according to Hamilton (2003)\(^10\), India has about 44% of flora, which is used medicinally. Although it is difficult to estimate the number of medicinal and aromatic plants present worldwide, the fact remains true that India with its rich biodiversity ranks first in its The existence of traditional medicine, depends on plant species diversity and the related knowledge of their use as herbal medicine. Both plant species and traditional knowledge are important to the herbal medicine trade and the pharmaceutical industry where plants provide raw materials and the traditional prerequisite information.\(^11\)
1. Introduction to Medicinal plants.

India has one of the richest plant medical traditions in the world. It is the tradition that is of remarkable contemporary relevance for ensuring health security to the teeming millions. There are estimated to be around 25,000 effective plant-based formulations, are used in folk medicine and are known to rural communities in India. There are over 1.5 million practitioners of traditional medicinal system using medicinal plants in preventive, promotional and curative applications. It is estimated that there are over 7800 medicinal drug-manufacturing units in India, which consume about 2000 tonnes of herbs annually.\(^{12}\) two of the largest users of medicinal plants are China and India.\(^{13-15}\)

1.1.2. Herbal medicine.

Herb has various meanings, but in simplest form, it refers to “crude drugs of vegetable origin utilized for the treatment of diseases, often of a chronic nature, or to attain or maintain a condition of improved health”. Herbal medicine, sometimes referred to as Herbalism or Botanical Medicine, is the use of herbs for their therapeutic or medicinal value. A herb is a plant or plant part valued for its medicinal, aromatic or savory qualities. Herbs plants produce and contain a variety of chemical substances that act upon the body. Herbal preparations called “phytopharmaceuticals”, “phytomedicine” or “phytomedicine”, are preparations made from different parts of herbs or plants. They come in different formulations and dosage forms including tablets, capsules, elixir, powder, extract, tincture, cream and parenteral preparations. A single isolate or active principle derived from plants such as digoxin or reserpine tablet is not considered herbal medicine.\(^{16-17}\)

**Herbal Remedies**

The effectiveness of herbal remedies, their easy availability, low cost and comparatively being devoid of serum toxic effects popularized them.
1. Introduction to Medicinal plants.

Table No -1.1.2. (a). Number of Plant species used medicinally worldwide.10

<table>
<thead>
<tr>
<th>Country</th>
<th>Plants species</th>
<th>Medicinal plant species</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>26,092</td>
<td>4,941</td>
<td>18.9</td>
</tr>
<tr>
<td>India</td>
<td>15,000</td>
<td>3,000</td>
<td>20.0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>22,500</td>
<td>1000</td>
<td>4.4</td>
</tr>
<tr>
<td>Malaysia</td>
<td>15,500</td>
<td>1,200</td>
<td>7.7</td>
</tr>
<tr>
<td>Nepal</td>
<td>6,973</td>
<td>700</td>
<td>10.0</td>
</tr>
<tr>
<td>Pakistan</td>
<td>4,950</td>
<td>300</td>
<td>6.1</td>
</tr>
<tr>
<td>Phillipines</td>
<td>8,931</td>
<td>850</td>
<td>9.5</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>3,314</td>
<td>550</td>
<td>16.6</td>
</tr>
<tr>
<td>Thailand</td>
<td>11,625</td>
<td>1,800</td>
<td>15.5</td>
</tr>
<tr>
<td>USA</td>
<td>21,641</td>
<td>2,564</td>
<td>11.8</td>
</tr>
<tr>
<td>Vietnam</td>
<td>10,500</td>
<td>1,800</td>
<td>17.1</td>
</tr>
<tr>
<td>Average</td>
<td>13,366</td>
<td>1,700</td>
<td>12.5</td>
</tr>
<tr>
<td>world</td>
<td>422,000</td>
<td>52,885</td>
<td></td>
</tr>
</tbody>
</table>

Table No-1.1.2. (b). Numbers and percentage of medicinal plant species recorded from different countries and regions (Hamilton, 2003).11

<table>
<thead>
<tr>
<th>Country or region</th>
<th>Total no. of native species of flora</th>
<th>No. of species of medicinal plants</th>
<th>% of flora which is medicinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>27,100</td>
<td>11,146</td>
<td>41</td>
</tr>
<tr>
<td>India</td>
<td>17,000</td>
<td>7,555</td>
<td>44</td>
</tr>
<tr>
<td>Mexico</td>
<td>30,000</td>
<td>2,237</td>
<td>7</td>
</tr>
<tr>
<td>North America</td>
<td>20,000</td>
<td>2,572</td>
<td>13</td>
</tr>
<tr>
<td>World</td>
<td>297,000-510,000</td>
<td>52,896</td>
<td>10-18</td>
</tr>
</tbody>
</table>
1.1.3. Popularity of herbal medicine

The herbal medicines are largely gaining popularity over allopathic medicine because of the following reasons favourable reasons:

- Rising costs of medicinal care.
- As these are from natural origin, so free from side effects in several cases.
- Goes to the root cause and removes it, so that the disease does not occur again.
- Freedom from approaching various specialists.
- Cure for many obstinate diseases.
- Easy availability of drugs from natural sources.

1.1.4. Need and Scope of herbal therapy

The treatment of diseases with pure pharmaceutical agents is a relatively modern phenomenon. However, as European explorers and merchants spread out to the Western and Eastern parts of the world, some of the benefits they would bring back were newly discovered pharmaceutical preparation of natural origin. One of the earliest success stories in developing a drug from a natural product was aspirin. Today we are more concerned with the life-style disease like depression, cancer and heart troubles caused by faulty nutrition and stress. The need of alternative therapy is to cover good health for all. Herbal therapy is one of the best practices to overcome illness. Traditional Indian practice held that certain drugs should be formulated through the addition of chosen substance that enhances bioavailability of the drug. Pepper has confirmed bioavailability enhancer property and point to the active component as the molecule piperine. An anti-TB drug Rifampicin has to be given at a higher dosage than required in order to compensate for losses on the way to the target site. Formulation of Piperine with Rifampicin will have counter effects.18-19
Hence one needs to be cautious while administering herbal medicine with any other formulations.

1.1.5. Herbal medicine drug-interactions

The potential risk of herbal medicine interacting with the prescribed drug is also a concern with the increased use of phytomedicine. Recently, several interactions have drawn the attention of the medical community. Janetzky and Morrealc reported a probable interaction between ginseng one of the most popular herbs with multiple health claims and warfarin, drug with numerous well-recognized drug-drug interaction.\(^\text{20}\)

1.1.6. Understanding Drug-Herb Interactions

Drug interactions occur by 4 major mechanisms.

- Altered drug absorption
- Altered renal (kidney) elimination of drugs
- Additive effects or toxicities (pharmacodynamic interaction)
- Altered hepatic (liver) metabolism of drugs

The first three account for a relatively small number of problems, while the fourth is the major culprit in drug interactions. The potential seriousness of drug interaction depends partly by the drugs involved. Some drugs have what is called a "narrow therapeutic margin" which means that there is relatively small difference between the amount of drug needed to achieve its beneficial effect and to that of causing adverse or unwanted effects. Classic examples of drugs falling in this category are anticoagulants (blood thinners like warfarin), which can cause bleeding if relative amounts of the drug is increased.
1. Introduction to Medicinal plants.

- **Absorption**

  When drugs are given orally they are usually absorbed into the bloodstream through the stomach. Changes in drug absorption may be due to alterations in pH, or acidity of the stomach, or by drugs binding together in the stomach to form complexes which cannot be absorbed. For example, when the molecule is too large to pass through the intestinal wall. Common examples include antacids, which increase stomach pH, and iron supplements, which can bind to some antibiotics, such as ciprofloxacin or tetracycline.

  Another issue for absorption is the "motility of the gastrointestinal tract", in other words, how fast or slow your guts are moving. If you have diarrhea, the drugs or herbs are moving through your system quickly and may have less time to be absorbed. Laxatives or bulk-forming agents speed up intestinal transit, and might interfere with intestinally absorbed drugs. Common stimulant laxative herbs are anthranoid-containing plants like senna, frangula, yellow dock and Chinese rhubarb, as well as Cascara sagrada and Aloe-Vera leaf. Bulk-forming agents include guar gum and psyllium. The clinical significance of these interactions are not clear.

- **Elimination**

  Drug interactions due to alterations in elimination of drugs through the kidney can only occur if a drug is primarily eliminated from the body through the kidney. If a drug or herb causes decreased kidney function, levels of the drugs eliminated through the kidneys may be increased as a result. Herbs containing diuretic properties, such as corn silk, dandelion, and juniper can increase the toxicity of lithium, a drug used to treat bipolar disorder.
Pharmacodynamic Interactions

Some drugs (and herbs) that may be given together have similar beneficial effects, or similar toxic effects- this is called a pharmacodynamic interaction. For example, two antiretroviral drugs can cause the side effects of peripheral neuropathy, increasing the likelihood of that side effect developing. Many drug-herb interactions fall in this category. For example herbs that have sedative properties, such as kava, nettle and sage may increase the sedative effects of some sleeping medications. Herbs that have antiplatelet activity, such as ginkgo biloba, ginger, ginseng, and garlic may increase the risk of bleeding in patients taking traditional drugs with antiplatelet activity or blood thinners. Herbs that can increase blood pressure, such as blue cohosh, ginger, liquorice and bayberry can interfere with the effectiveness of drugs used to treat high blood pressure.

Liver Metabolism

The most complicated drug interactions, and those with the greatest significance for antiretroviral medications, are those resulting in altered liver metabolism of drugs. The activity of liver enzymes which are responsible for breaking down drugs can be increased (induced) or decreased (inhibited) by drugs or herbs. Many antiretroviral medications are enzyme inducers, enzyme inhibitors, or even both, at the same time. The resulting drug interactions are complex, and not always predictable. Ritonavir, a protease inhibitor, is a powerful inhibitor of liver metabolizing enzymes, and can dramatically increase the blood levels of other drugs metabolized by the same enzymes. This interaction can be used to our benefit, so that lower doses of the drugs affected are required to achieve the same effect. If dosage adjustments are not made however, toxic levels of the affected drug could result.
Nevirapine, another antiretroviral is an enzyme inducer, and can decrease the blood levels of other drugs metabolized by the same enzymes. If we know how each drug is metabolized and how it affects metabolizing enzymes, we can predict the response and be prepared. Many drugs in a wide variety of therapeutic categories are metabolized by liver enzymes and subject to this type of interaction. These include drugs used to treat anxiety and insomnia (diazepam and some of its relatives), drugs used to treat depression, some anti-arrhythmics (used to treat abnormal heart rhythms), oral contraceptives, painkillers and recreational drugs.

1.1.7. Common Medicinal Plants Reported To Interact With Pharmaceuticals

A comprehensive search of interactions between commonly used medicinal plants and pharmaceutical drugs recently published in clinical reports suggest that potential interactions with the following herbals, betel nut, chilli pepper (capsicum), Danshen, Devils claw, dong quai, eleuthero or siberian ginseng, garlic, gingko, ginseng, guar gum, karela or bitter melon, liquorice, papaya, psyllium, St. John’s wort, Saiboku-to (Asian herbal mixture); Shankhaspushpi (Ayurvedic mixed-herb syrup); Sho-saiko-to or xiao chai hu tang (Asian herbal mixture), tamarind, valerian and yohimbine.

Some specific cautions are that people with clotting disorders, those awaiting surgery, or those on anticoagulant therapy should be aware that ginkgo, danshen, dong quai, papaya, garlic, feverfew, ephedra or ginseng may cause unexpected bleeding, increase bleeding times or inhibit blood clotting for about two weeks after you stop taking the herb. People taking protease inhibitors, serotonin re uptake inhibitors (newer antidepressants), cyclosporin, digoxin, phenprocoumon need to consider potential interactions with St. John’s wort. Ginseng may interact with phenelzine, another antidepressant.
1. Introduction to Medicinal plants.

People taking tricyclic antidepressants should avoid yohimbine. Liquorice, which has been shown to have antiviral properties and is a very common ingredient in Chinese herbal remedies, can have an additive synergistic effect with corticosteroids. Corticosteroids, like prednisone are commonly prescribed to ulcers in the throat and mouth that don’t respond to topical preparations, or to treat rashes associated with some antiretroviral. These are only some of the herb-drug interactions for which clinical reports have been made. Many others are possible, and indeed likely. The complexity and potential gravity of drug-herb interactions makes exercising caution and consulting a pharmacist or physician important.21

1.1.8. Toxicology & Herbs

In recent years there have been reports of deaths and poisonings attributed to the use of medicinal plants such as comfrey and chaparral. Herbalists have a responsibility to determine the truth/accuracy in such reports. Literature concerning poisonous plants is replete with misinformation and erroneous reporting.20 the same mistakes continue to plague the reporting of poisoning by medicinal plants.21, 22

➢ Toxicology

The word toxicology is derived from toxicon - a poisonous substance into which arrow heads were dipped and toxikos - a bow. Toxicology is a relatively young biological science that involves a complex interrelationship of dose, absorption, distribution, metabolism and elimination.

➢ A poison

A poison is any substance which has a harmful effect on a living system. Paracelsus (1493-1541) was one of the first to distinguish between the therapeutic and toxic properties of substances.
He thought that the only difference between a medicine and a poison was the dose. Very few substances are actually classed as a "poison". Harmful chemicals are not necessarily poisons. We are exposed to potentially toxic substances every day without immediate harm. Our bodies can usually safely metabolize toxins if we are exposed to them in small amounts. It is only when we overwhelm our body and reach the toxic dose of a substance that life-threatening results occur. That is, all substances have a potential toxicity. All herbs can therefore be harmful, but most would have to be ingested in large amounts to cause harm. Herbs which have a high toxicity, such as Gelsemium and Aconitum, can be used safely and effectively if taken in small, therapeutic doses. Thus, the primary determinate of the safety of a substance is the dose. It is the dose, not the herb, which makes the poison. A correct use of semantics and a correct understanding of these terms are crucial to avoid confusion and misinformation.

For example,

- Vitamin D has a very high acute toxicity. It would have had to carry a poison label but it has been exempted from the Federal Hazardous Substances Labeling Act because it is classified as a food and a drug.

- Salt is not toxic in small doses. But a single large dose can be lethal. Just two tablespoons can kill a one-year-old child.

- Caffeine, one of the many alkaloids found in coffee can kill - at a dose of 100 strong cups of coffee.

- A litre of scotch contains a lethal dose of ethanol.

- Water can be lethal if you drink enough of it in a short period of time.
These are substances that are foreign to the body or exogenous as compared to substances produced by the body or endogenous. It is important to point out that endogenous substances can also cause poisoning and death. Toxic substances fall into several classes in relation to how people are exposed to them. They can be put under the class as food additives, drugs, pesticides, industrial chemicals, environmental pollutants, household poisons and natural toxins. Many natural products used in medicine are derived not only from plants, but also from marine organisms like starfishes, sea urchins, sea cucumbers and fish.

- **Dose-response relationship**
  
  Toxicity depends not only on the dose of the substance but also on the toxic properties of the substance. The relationship between these two factors is important in the assessment of therapeutic dosage in pharmacology and herbalism.\(^\text{23}\)

- **Plant substances can harm.**

  Toxicants can interrupt metabolism of carbohydrates, lipids and proteins and alter synthesis, release and storage of hormones.

- **Here are some examples of how substances from plants can harm.\(^\text{24}\)**
  
  - Oxalate crystals from *Halogiton glomeratus* can damage the tubules in the kidney. Because they are insoluble, precipitate and collect in the kidney tubules to then obstruct them.
  
  - The alkaloid, aconitine in aconite, affects the sodium channels on the cell membrane which can lead to increased uptake in sodium and other ions. This can lead to cardiac arrhythmias and depression of respiration.
  
  - The psychotropic plant alkaloids, harmine and harmaline resemble serotonin and are thought to block the serotonin receptors in the brain.
1. Introduction to Medicinal plants.

1.2. REVIEW OF LITERATURE ON SELECTED PLANTS.

1.2.1. REVIEW OF LITERATURE ON Annona squamosa. L.\textsuperscript{25-40}

Family : Annonaceae  
Genus : Annona  
Species : squamosa  
Common name : Custard apple, Sitaphala  
Duration : August-January  
Voucher No : HGUG-19

Habitus. In gardens, all over India.

Geographical distribution: It grows wild in the central provinces, western peninsula, South India & Ceylon.

Morphological Characters

Key characters: Annona squamosa. L is a small, semi deciduous, much branched shrub or small tree irregularly spreading branches and a short trunk.

- **Leaves.** Thin leaves occur singly, long and wide, Leaf stalks are long, green, and sparsely pubescent

- **Flowers.** Solitary or in short lateral clusters greenish-yellow flowers on a hairy, slender long stalk. Green outer petals, purplish at the base, oblong, wide, inner petals.

- **Stems.** Branches with light brown bark and visible leaf scars; inner bark light yellow and slightly bitter; twigs become brown with light brown dots
1. Introduction to Medicinal plants.

- **Fruits.** The round or heart-shaped greenish yellow, ripened aggregate fruit is pendulous on a thickened stalk; many round protuberances and covered with a powdery bloom.

  Fruits are formed of loosely cohering or almost free carpels (the ripened pistils).

- **Seed** each carpel containing an oblong, shiny and smooth, dark brown to black,

**Medicinal uses of Annona squamosa. L**

The treatment of epilepsy, dysentery, cardiac problem, worm infection, constipation, hemorrhage, antibacterial infection, dysuria, fever, ulcer. Anti fertility, anti tumor and abortifacient properties.

**Biological uses reported in literature.**

- **Leaves:** The leaf extract being used for ameliorate hyper thyroidism. An insecticidal agent. Free radical scavenging activity, Hypoglycemic anti diabetic effect and Hepato protective activity.

- **Bark and root:** Ethanolic extract of leaves and stem are reported to have an anticancerous activity.

- **Seeds:** Antibacterial and antiovulatory have been studied with seed extract.

**Chemical constituents**

- **Leaves:** Aporphine alkaloids, flavonoids, glycoside,

- **Root:** Terpine derivatives and novel diazepine,

- **Seed:** squamoline
1. Introduction to Medicinal plants.

1.2.2. REVIEW OF LITERATURE ON *Argemone Mexicana*. \(^{41-47}\)

<table>
<thead>
<tr>
<th>Family</th>
<th>Papveraceae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genus</td>
<td><em>Argemone</em></td>
</tr>
<tr>
<td>Species</td>
<td><em>mexicana</em></td>
</tr>
<tr>
<td>Common name</td>
<td>Prickly poppy</td>
</tr>
<tr>
<td>Duration</td>
<td>August-January</td>
</tr>
<tr>
<td>Voucher No</td>
<td>HGUG-614</td>
</tr>
</tbody>
</table>

**Habitus.** In gardens, all over India.

**Geographical distribution:** prickly herb naturalized throughout India up to 5000 feet in wastelands and along roadsides.

**Key characters:** *Argemone Mexicana*. L is a small, semi deciduous, much branched shrub irregularly spreading branches and a short trunk.

- **Leaves.** Alternative or radical, with sessile, semi-amplxicaul, sinuate-pinnatified leaves, variegated with white.
- **Flowers.** Terminal, bright yellow colored, pis 1-3 cm.
- **Stems.** Cylindrical, herbaceous (green), prickly and branching.
- **Seed.** Seeds numerous.

**Medicinal uses of *Argemone mexicana* L.**

Whole plant bitter, diuretic, purgative, destroys worms, cures itching, leprosy, various skin diseases, reduce inflammation and bilious fevers, useful instangury. An antidote to various poisons, enriches the blood, a good expectorant and aphrodisiac.
I. Introduction to Medicinal plants.

Root an antielmintic, stimulant and chronic cases of skin diseases. Leaves are used for cough. Seeds are used purgative, sedative. Juice is useful in leprosy, cutaneous affections; scabies oil is a better preparation than juice.

Biological uses reported in literature.

- **Seed.** Toxicity, anti-HIV.

Chemical constituents.

- **Leaf.** Berberine, protopine nitrate, phenolics,
- **Bark and Root.** Fatty acids, alkaloids.
- **Seed.** Allocryptonine, sanguinarine, long chain alcohol,
1. Introduction to Medicinal plants.

1.2.3. REVIEW OF LITERATURE ON *Calotropis gigantia*. Br\textsuperscript{48-51}

Family : Asclepidaceae  
Genus : *Calotropis*  
Species : *gigantia*  
Duration : August-January  
Voucher No : HGUG-47

**Habitus.** In gardens, all over India.

**Geographical distribution:** distributed throughout India.

**Key characters:** *Calotropis gigantia* a tall shrub reaching 2-4 to 3 m length.

- **Leaves.** Leaves sessile or nearly so, elliptic ablong, acute thick, glaucous.
- **Flowers.** Flowers are purplish or white, buds ovoid, corolla 2cm long or more, follicles 9-10 cm long.
- **Stems.** Branches with light brown bark and visible leaf scars; inner bark light yellow and slightly bitter; twigs become brown with light brown dots.
- **Seed.** green seeds numerous, 6 by 5 mm, ovate.

**Medicinal uses of *Calotropis gigantia*. L.**

Latex is applied externally to corns. Antipyretic activity, whole plant cures leprosy, leucoderma, ulcers, tumors, piles, diseases of spleen.

**Biological uses reported in literature.**

- **Leaves.** Are applied to paralysed parts, painful joints, swelling, heal wound. Useful in leprosy, scabies. Applied to painful joints and swellings.
1. Introduction to Medicinal plants.

- **Flowers.** Are anthelmintic, analgesic, astringent, cures inflammations, tumours.
- **Bark and Root.** Antimicrobial activity, cytotoxic activity.
- **Seed.** Antimicrobial activity.

Chemical constituents

- **Leaves.** Steroids, flavonoids.
- **Bark and Root.** Alkaloids.
- **Seed.** Oil.
1. Introduction to Medicinal plants.

1.2.4. REVIEW OF LITERATURE ON Cassia auriculata L.\textsuperscript{52-67}

- **Family**: Caesalpiniaceae
- **Genus**: Cassia
- **Species**: auriculata
- **Common name**: Avaram, Tanners
- **Duration**: August-January
- **Voucher No**: HGUG 222

3.1.2. Geographical distribution: It grows wild in the central provinces, western peninsula, South India & Ceylon.

3.1.3. Morphological Characters.

**Key characters**: A tall much branched shrub, bark with smooth reddish brown branch lets finely pubescent.

- **Leaves**: long, rhachis densely fulvous-pubescent with an erect linear gland between each pair of leaflets, stipules foliaceous, reflexed, very large, rotundate-reniform, produced at the base on the side next the petiole into a long subulate point, persistent. Leaflets 8-12 pairs, overlapping, oblong-ovate, and obtuse or emarginated, mucronate, glabrous or finely downy, dull green above, base usually rounded, petioles long.

- **Flowers**: Flowers large, reaching 5cm across, in terminal and axillary corymbose racemes pedicels long, bracts ovate, acuminate, caduceus, calyx glabrous, segments leathery, concave. Petals with long claws crisped on the margin, bright yellow, veined with orange. Stamens 10, of which the 3 upper are reduced to staminodes, the remaining 7 perfect, of which the 3 lower are larger than the 4 lateral ones. Flowers from October-May.
1. Introduction to Medicinal plants.

- **Pods**: flat, thin, papery, oblong, obtuse, mucronate, pale brown, deeply depressed between the seeds, having a crupled appearance, transversely veined, pubescent, fruits mature from January-June depending on locality.

- **Seeds**: 10-20 per pod, obovate, dark brown with hard shiny seed coat.

3.1.4. Medicinal uses of *Cassia auriculata* L.

- **Plant**: The whole plant is used in diuresis and diabetes mellitus.

- **Bark and root**: Astringent.

- **Roots**: Cooling, alterative, depurative and alexeteric, and are useful in skin diseases, leprosy, tumors, asthma and urethrorrhoea.

- **Bark**: Astringent and alterative and a decoction of this is used as enemas and gargles, and in the treatment of rheumatism and eye diseases.

- **Leaves**: Leaves are depurative and anthelmintic and are recommended for leprosy, skin diseases, ulcers and hepatoprotectivity.

- **Flowers**: The flowers are used in urinary discharges, nocturnal emissions, and diabetes, throat troubles.

- **Fruits**: Anthelmintic, useful in vomiting, thirst and urinary discharge.

- **Seeds**: Ophalmia and conjuctivities in diabetes and chylons urine, and also used as astringent, sour, cooling, constipating, depurative, aphrodisiac, anthelmintic, stomachic, dysentery, diarrhoea, swellings, abdominal disorders, leprosy, skin diseases and worm infestations.

- **Twings**: The twings are used as tooth brushes.

- **Parts used**: Bark, root leaves, flowers, fruits, seeds.
1. Introduction to Medicinal plants.

3.1.5 Biological uses reported in literature

Dried flowers and leaves of the plant are being used for medicinal treatment. Extract made from the flowers and seeds have been shown to antidiabetes activity ethnomedically. Plant has been shown to antiviral and anti spasmodic activity. Flower and leaf extract shown to antipyretic activity. Leaf extract also shows emollient effect.

Antihyperglycemic activity was inactive in rabbit and does in doses up to 50mg/kg body weight. An aqueous leaf extract was found to lower the serum glucose level at body weight. Effect of flowers on blood sugar levels, serum and tissue lipids in streptozotocin diabetes rats. Antiperoxidative effect of flowers in streptozocin diabetic rats. Leaf extract in rats with alcoholic liver injury. Effect of Cassia auriculata L. Root extract on cisplatin and gentamicin-induced renal injury. Antioxidant activity of Cassia auriculata L. flowers.

3.1.6 Chemical constituents

- **Flowers:** β-sitosterol and kaempferol, proanthocyanand dimmer.
- **Leaves:** β-sitosterol and emodin, and 4, 5, 7. trihydroxyflavan-3, 4-diol also known as leucoanthocyaningoratesidine, flavonoids and anthracene derivatives, β-sitosterol β-D-glucoside, quercetin 3-O-glucoside, rutin.
- **Seeds:** Polysaccharide, Oligosaccharide, amino acids.
- **Bark:** Tannins
- **Stem bark:** Catechin, fisetinidol-(4α>8) epicatechin, fisetinidol-(4α>8) - gallocatechin, and fisetinidol-(4α>8) epigallocatechin.
- **Root:** Flavone glycoside 7, 4, dihydroxy flavone-5-O-β-D-galactopyranoside.
- **Pod husk:** Chrysophenol, emodin, rubiadin and β-sitosterol.
- **Whole plant:** Protein, free amino acids, tannins and nonacosan-6-one.
1. Introduction to Medicinal plants.

1.2.5. REVIEW OF LITERATURE ON *Ficus religiosa* L. \(^{68-70}\)

<table>
<thead>
<tr>
<th>Family</th>
<th>Moraceae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genus</td>
<td><em>Ficus</em></td>
</tr>
<tr>
<td>Species</td>
<td><em>religiosa</em></td>
</tr>
<tr>
<td>Common name</td>
<td>Ravi</td>
</tr>
<tr>
<td>Duration</td>
<td>August-January</td>
</tr>
<tr>
<td>Voucher No</td>
<td>HGUG 587</td>
</tr>
</tbody>
</table>

**Habitus.** In gardens, all over India.

**Geographical distribution:** It distributed in sub- Himalayan forests, Bengal, central India.

**Morphological Characters**

**Key characters:** *Ficus religiosa* L. is a large tree, much branched, irregularly spreading branches.

- **Leaves.** Coriaceous, ovate-rotund, narrowed, upwards, base broadly ovate, stamen 1, anthers single, ovate-round, filament short, lanceolate, style short, lateral, stigma rounded.

- **Stems.** Branches with light bark and visible leaf scars; inner bark light yellow and slightly bitter; twigs become brown with light brown dots

- **Fruits.** The round or heart-shaped greenish, ripened aggregate fruit is pendulous on a thickened stalk;

- **Seed.** Each carpel containing an oblong, shiny and smooth, brown to black,

**Medicinal uses of *Ficus religiosa* L.**

Plant parts are bitter, sweetish, acrid, cooling, and useful in diseases of the blood, vagina, uterus, leucorrhoea, burning sensation.
Ripe fruit is cooling, alexipharmic; good for burning sensation, foul taste, and fruit is laxative and helps in digestion, purgative, aphrodisiac, checks vomiting. Infusion of bark given internally in scabies. A paste of powdered bark is used as absorbent in inflammatory swellings. Hypolipidemic.

Chemical constituents

- **Leaves.** Flavonoids, triterpenes.
- **Bark and Root.** Tannins.
1. INTRODUCTION TO MEDICINAL PLANTS.

1.2.6. REVIEW OF LITERATURE ON Jatropha curcas L. 71-75

- **Family**: Euphorbiaceae
- **Genus**: Jatropha
- **Species**: curcas
- **Duration**: August-January
- **Voucher No**: HGUG 1295

**Habitus.** In gardens, all over India.

**Geographical distribution:** It is distributed throughout India, common hedge plant along roadsides and outskirts of villages.

**Morphological Characters**

**Key characters:** *Jatropha curcas* L. Shrub or small tree. Up to 5 m tall.

- **Leaves.** The leaves have significant variability in their morphology. In general, the leaves are green to pale green, alternate to sub opposite, and three- to five-lobed with a spiral phyllotaxis.

- **Flowers.** Male and female flowers are produced on the same inflorescence, the petiole length ranges from 0.24 to 0.90 inches (6.1–23.1 mm). The inflorescence can be formed in the leaf axil. Plants are monoecious and also present hermaphroditic flowers occasionally. Unisexual, monoecious, yellowish green in loose panicle of cymes.

- **Fruits.** Fruits are produced in winter, or there may be several crops during the year if soil moisture is good and temperatures are sufficiently high. Most fruit production is concentrated from midsummer to late fall with variations in production peaks where some plants have two or three harvests and some produce continuously through the season.
1. Introduction to Medicinal plants.

- **Seed.** The seeds are mature when the capsule changes from green to yellow. The seeds contain around 20% saturated fatty acids and 80% unsaturated fatty acids, and they yield 25%–40% oil by weight.

**Medicinal uses of *Jatropha curcas* L**

Drug obtained from *Jatropha curcas* is termed as ‘Dravanthi’ it is bitter, pungent and astringent in taste. It has anthelmintic; it is beneficial in chronic dysentery, thirst, urinary discharges, anaemia, fistula, ulcer and diseases of heart and skin. The young leaves may be safely eaten, steamed or stewed.

Cooked with goat meat, they are said to advantageously counteract its smell. Pounded leaves are applied near horses' eyes to repel flies in India. The extracts of the plants are dangerous to use but water can easily release it over if not too much extract is applied. Oil of seeds used externally for rheumatism and paralytic. Milky say is used for the treatment of different dermatomucosal diseases such as gingivitis, wounds, haemorrhoids, herpes, sores, burns, ulcers, and warts.
1. Introduction to Medicinal plants.

1.2.7. Within the frame work of thesis.

Natural product once served as the only source of medicines for mankind. Screening of natural products, especially those having medicinal use, structure determination and biological activity has been an important aspect in chemistry. A good number of bioactive compounds isolated from medicinal plants and their semi synthetic and synthetic analogs have found to have wide application in chemotherapy. Some of the synthetic derivatives have by far surpassed the naturally occurring moieties due to their applicability in various fields. In recent years, the chemistry of natural products have been extended to enormous length and as a result large number of bioactive natural products, their lead and synthetic derivatives have been synthesized.

The present investigation mainly describes the antioxidant screening of different plant extracts; resulting in bioactivity guided selection of *Annona squamosa*. L an effort in isolation of active constituent(s) from active extract from *Annona squamosa*. L has been made. Further various biological screening of the active extracts as well as isolated active compound has been undertaken. Their efforts have been discussed in the present thesis.

The thesis divided into seven chapters

Chapter I

This chapter divided into two parts, first part deals with general introduction to medicinal plants. The second part deals with review of selected medicinal plants-work within the frame of this thesis.

Chapter II

This chapter divided into to three parts, first part deals with general introduction to antioxidant, second part deals with identification of six plants, collection, extraction and
1. Introduction to Medicinal plants.

Phytochemical screening of selected plants, third part deals with method adapted by us for evaluating antioxidant potential and results and discussion of antioxidant screening of various plant extracts and conclusion.

Chapter III

This chapter divided into three parts, first part deals with review of *Annona squamosa* L. Second part deals with collection, extraction and phytochemical screening of different part (leaf, root, and seed) of *Annona squamosa* L plant, third part deals with evaluating antioxidant potential and, results and discussion of antioxidant.

Chapter IV

This chapter divided into three parts, first part deals with introduction of *Annona squamosa* L. Second part deals with collection, extraction and phytochemical screening of different extracts of leaf part of *Annona squamosa* L plant, third part deals with evaluating antioxidant potential and, results and discussion, of antioxidant.

Chapter V

This chapter divided into two parts, first part deals with collection, extraction of leaf part of *Annona squamosa* L. Second part deals with the isolation of chemical constituents from ethanol extract and structural elucidation – physical data – interpretation.

Chapter VI

The part deals with evaluating antioxidant potential of isolated compound(s) and, results and discussion of antioxidant.
**Chapter VII**

This chapter divided into three parts, first part deals with general introduction to microbial, second part deals with method adapted by us for evaluating antimicrobial potential and, results and discussion of antimicrobial screening of *Annona squamosa* L plant extracts.

**Appendix.**

1) Computer aided Drug design related to Rutin.

2) Application of Briggs – Rauscher reaction for measurement of antioxidant capacity.
1. Introduction to Medicinal plants.

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