CHAPTER 1

Introduction

Plants have been used for the treatment of diseases from time immemorial and were still principal form of medicine in the most developed countries till about 70 years back. Till the end of 20th century every village and rural community had a wealth of herbal folk, which is seen even today. The herbs were picked up for range of common health problems and were taken as tea, applied as lotions or even mixed with fat and rubbed as ointment and for the treatment of many disorders. Every minute observation coupled with experience from trial and error has played a very important role in evolution of herbal medicines. The green plants and herbs are the just like store houses of different types of chemicals constituents. These plants provide food, medicine, cloths and shelter for human being.

Human being appear to be cause problems with more disorders and diseases than any other living organism. If any person is suffering from any type of diseases or injury then before taking advantages of herbal or any medicinal plants, he thinks several times about use. In the past, almost all the medicines used were from natural sources like herbs and plants. The plants are very useful for various applications. Today a huge store of knowledge concerning therapeutic properties of different plants has accumulated. All phyla of plants like pteridophyte, bryophyte, thalophyte, and spermatophyte contains species that yield unofficial and official products of medicinal importance. By far away, the maximum numbers of these are derived from plants and consist of recognized families of spermatophyta which are more than three hundred.

Herbal medicines are very beneficial and safe. It’s use is considered as often compliment treatment mainly by providing well-tolerated and safe, remedies for chronic illnesses. In western countries experience of traditional medicine is a dramatic renaissance. Nowadays no effective conventional treatments exist for much continual sickness such as arthritis, asthma, irritable bowel syndrome, liver disorders, diabetes, HIV infection etc. The concern over the side effects of modern medicine is also encouraging people to look for more gentle forms of treatment like herbal medicine. Many medicine are used as conventional medicine but their origin is from
Natural products are the origin of more than 50% of modern drugs that are useful for the treatment of various types of diseases without any side effects. In the development plans and programs of pharmaceutical industries, the chemical contents of plants play a vital role.

In aspirin medicine, salicylic acid is present, which is used for heart pain treatment. Quinine is used for the remedy of malaria. It was derived from Cinchona bark. Paregenic, codeine, and morphines are derived from opium poppy and used in the treatment of diarrhea. Morphine alkaloid is used to get pain relief. In cancer chemotherapy, tetrahydrocannabinol is used, which is derived from cannabis sativa, specifically used to reduce nausea.

According to the World Health Organization (WHO) calculation, approximately 80-85% of people in the world prefer herbal medical treatments to cure their health problems.

The traditional medicines occur widely in nature and are essential for the treatment of disease in animals and humans. In India, animal health issues are more related to rural areas. For the rural people, the use of synthetic medicines is unaffordable because of their high cost. This shows the importance of traditional medicines which are affordable, effective, and with minimum or no side effects. The modern era demands scientific evidences to prove the safety and efficacy of traditional preparations. The WHO has emphasized the need to ensure the quality control of herbs and herbal formulations by using modern techniques. The full potential of medicinal plants research should focus on authentication of herbal raw materials. Therefore, standardization of traditional preparations used for the treatment of diseases is important. Worldwide demand for natural products is increasing because of their eco-friendly beneficial nature. These natural products are the source of different medicines as well as natural colorants which are very beneficial to society. The term of natural products involves chemical substances which are extracted from living organisms. Natural products are nitrogen-containing cyclic compounds. In this cyclic compound, nitrogen is present in a negative state. There are 10,000 types of alkaloids found from different sources with different structures. These alkaloids are very beneficial for curing various disorders. Alkaloids show various types of structures. Such alkaloids are found in living organisms.
According to R.F. Raffauf, from 300 different families the various types of 10,000 alkaloids are discovered and extracted from more than 300 different types of plants families (Raffauf R.F; 1996). Some alkaloids are also produced synthetically as per the demand and use. Because of isomeric type of structure of alkaloids shows, many chemical properties and physiological actions. Naturally occurring alkaloids are nitrogenous compounds that are the pharmacogenically active basic principles of flowering plants.

THE TRADITIONAL AND ALTERNATIVE SYSTEM OF MEDICINES:

Indian system of medicine- Ayurveda

Ayurveda Indian system of medicine wellknown and one of the most noted system of medicine in the world. In Sanskrit the meaning of Ayurveda is science of life. The meaning of Ayu is life and Veda means science. The aim is associated to holistic management disease and health. It is considered as ancient, most traditional and medical systems which has been broadly used and practiced in sub continent of India. It has sound of, experimental and experiential philosophical basis.

Samhita Charak and Sushrut (100–500 B.C.) are major classes of ayurveda and described more than 700 plants with therapeutic, pharmacological properties and its classification. Therapy like Rasayana is one of the branch out of eight branches of ayurveda. It is consists of nutritious and refreshing drugs with various applications for, improvement of memory, durability, immunomodulation, adaptogenic activity. Many researchers have theoretical the neuro-endocrine immune axis theory to explain Rasayana activity and they have considered it to be an innovative source of immune drugs.

New algorithms and programs are need for the better understanding of basic principles of ayurveda and harmonization of various practices which increases conclusion with a system in practice.
The concept of ayurveda and the Prakriti for the entire human being significance in therapeutics point out physically powerful hereditary implication and can form basis of customized medicine and pharmacogenomics.

An ancient science of life is believed to be prevalent for the last 5000 years in India. Ayurveda is based on the hypothesis that everything in the universe is composed of five basic elements viz. air, energy, space, liquid, and solid. They exist in human body in combined form like vata (space and air), pitta (energy and liquid) and kapha (liquid and solid). Vata, pitta, and kapha together are called tridosha. Tridosha is three pillar of life. It is believed that they are in harmony with each other, but in every human being one of them is dominating which is in turn is called as the prakuti of that person. Tridosha exists in human body in seven form called saptadhatu, viz. Rasa (lymph), Rakta (blood), meda (adipose tissue), mamsa tissues are subject to wear and tear so that mala (excretory material) is formed from them. When tridisha, saptadhatu, and mala are in balance with each other, it is called healthy characters of medicinal herbs. Viz. Rasa, guna, virya, vipak and prbhava can be complied by the ancient Indian medicine practitioners in the forms of called samhitas and other similar books. Ayurveda farmacy (Bhaishhayya – vigyan) proposes five basic dosage forms like swaras, kalka, kwath, Hima and plant. A number of other doses like churna, avaleha, ghrita sandhana, kalpa and blasma are prepared from them. Mostly all of them are polyherbal formulations. Plant products have been part of phytomedicine since time immemorial. This can be derived from barks, leaves, flowers, roots, and seeds. Some important medicinal herbs in Ayurveda are Rauwolfia serpentine, Asparagus racemosus, Cassia angustifolia, Sesamum indicum, Holarrhena antidysenterica, piper longum, Acontium napellus etc.

Unani system of Medicine:

The system unani medicine is emphasizes through pulse, wine, and stool. It gives importance for the environment and ecological condition of area in which human are survived. The unani system of mediine aims at treating the cause of diseases and not its symptoms. For this purpose, through history of patient is recorded in addition to his pulse, urine, and stool examination. The disease condition is considered to be due to the imbalance between humors and accordingly, treatment is given. The drug are
polyherbal formulations and their collective effect is considered. The root of the system go deep in to the time of wellknown Greek philosopher Hippocrates who is credited with it. Aristotle Golen made valuable contribution to it. This system of Greek origin was further carried over to Persia (Iran) where it has been improved by Arabian physicians. This system is based on two theories viz. the Hippocratic theory of four humors and the Pythagorian theory of four proximate qualities. The four humors are blood, phlegm, yellow bile and black bile, while the four qualities are the states of living human body like hot, cold, moist and dry. Earth, water, fire and air represent them.

Unani system of medicine is called by various names in different parts of the world such as Arab medicine, Greco-Arab medicine, Loniah medicine, Islamic medicine and also oriental medicine.

**Homeopathic system of Medicine:**

Homeopathy is a new method in comparison to other system of medicine. It has been developed in the eighteenth century of Samuel Hahnemann a German physician and chemist. He proposed that the cause of the diseases itself can be used for its treatment and remedy. Hahnemann put forward the law of similar. This law says that like cures like. With this principle, he proved that cinchona can produce the symptoms of malaria. He succeeded in getting appropriate results with a large numbers of extract prepared from plants minerals and animals. He compiled all the observations and results and that is called as organon of Medicine.

The drug treatment is not specified in homeopathic system, but the choice of drug depends on clinical conditions of patient and symptoms. This is based on the concept prover and proving. The healthy person is called as prover and symptoms created by different doses of drug extracts are noted which is called proving. It specifically consider mental, emotional and physical changes of the prover. Consequently these symptoms are compared with patient with similar symptoms and accordingly the same type of extract is given for treatment. During the treatment, the drug extract are extremely diluted, which is believed to cause potentiation and enhancement of curative effect. The drugs are extracted from mother tincture, which is further diluted in terms of
decimal or centesimal potencies. Various medicinal plants are used in homeopathy are nux vomia, Thuja occidentalis, Colchium automnale, Aconitum napellus etc.

**Traditional Chinese medicine and kamph system:**

The Chinese system of medicine is still widespread. The system finds its reference in yellow Emperor's class of internal medicine. (Huang Di Nei Jing) which is believed to be prepared between 200 BC and 100 AD. The herbal is based on the idea that all life is subjected to natural laws. The hypothesis includes two quite different systems the ying and yang theory and the five elements theory (i.e., water, metal, earth, fire and wood). These two theories have been developed separately and differ in terms of diagnosis and treatment. The ying and yang theory say that everything in the universe consists of dark and light side. Dark means yin and light means yang. These are complementary opposite like wet and dry, up and down or dry and light. The five elements theory proposes that each element leads to the next in a continuous fashion like fire to metal, to wood, to earth, to water and so on. The elements are the five phases indicating the process of continuous movements of life. The elements play a dynamic role in the Chinese system of medicine like in making groups like herbal tastes and parts of body.

According to this system, disease conditions are expression of imbalance in ying and yang like excess or deficiency of either of them. For example, shivering occurs due to the excess of ying while excess of yang causes fever. The treatment makes use of various herbs especially formulation. The important herbs from the system are Ephedra sinica, Rheum palmatum, Carthamus tinctoria, Cleodendron trichotomum, panas gindeng, Schisandra chinensis, Schizonepeta tenuifolia, Agastache rugosa etc.

The traditional system of medicine has spread to Japan and Korea in a form called Kamph, the traditional system of Japanese medicine. Although it has developed its own characters giving importance to the Japanese style of simplicity and naturalness, still the basic idea like ying and yang has a crucial role in Kamph medicine. As compared to Kamph, the Korean system is much similar to the Chinese system and includes most of the herbs in it.

**CLASSIFICATION OF CRUDE DRUGS:**
Crude drugs are generally applies to the products from animals and plant. Its origin found in a raw form. However the term is also applied to inclusion of farmaceutical products from mineral kingdom in the original form and not essential only of organic origin such as kaolin, betonite etc. The term crude drug is referred in relation to the natural product that have not been advanced in value and improved in condition by any process or treatment beyond that which is essential for its proper packing and prevention from deterioration. Crude drugs are further grouped as organized (cellular) or unorganized (acellular). According to whether they contain a regular organized cellular structure or not. Organised drugs comprise those crude drug material, which represents a part of the plant and therefore, made up of cell. Unorganised drugs are a diverse group of solid and liquid materials which do not consist of parts of plants and are obtain form natural sources by a verity of extraction. In pharmacognosy, the crude drugs may be classified according to their Alphabetical status, Taxonomy of plants and animals from which they are derived. Morphology, Chemical nature, Chemotaxonomical status, Pharmacological action and therapeutics application. It should not be noted that none of this systems give a total profile of natural drugs and each has its own limitations.

1. Alphabetical classification

The crude drugs are arranged according to the alphabetical order of their Latin and English name. Some of the Pharmacopoeia and reference books, which classified crude drugs according to the system, are:

- Indian pharmacopeia
- British pharmacopeia
- United state pharmamcopia and Natural pharmulary
- British pharmaceutical codex
- Eurepean pharmacopeia (Latin title)
Encyclopedia of common natural ingredients used in drugs and cosmetics. For example, Acacia, benzoin, Chinchora, dill, ergot, fennel, gentain, hyoscyamus, ipecacuanha, jalap, khurchi, liquorice, mirrh, nux-vomica, opium, podophyllum, quassia, rauwolfia, senna, uncaria, gambier, vasaka, woolfat, yellowbees—wax.

2. Taxonomic classification

The drugs are classified according to plant or animals from which they are obtained in phyla, order, families, genera species, subspecies etc. This method of classification is based on the consideration of natural relationship or phylogeny among plants and animals. The crude drug of the plant origin are classified on the basis of one of the accepted system or botanical classification. A large number of plant families have certain distinguishing characteristics that permits crude drugs from these families to be studied at one time. Thus drugs obtained from plants having alternate leaves, cymose flowers and fruits that are berries or capsules (hyoscyamus, datura, belladona and stramonium) are considered with other members of solanaceae. This system of classification is criticized for its failure to recognize the organized and unorganized nature of crude drugs. At first site this classification looks appealing, but many are not entire plants and represent the parts of the plants that have been proceed systematically. Further the system fails to take in to account chemical nature of active constituents and theropetic significance of crude drugs.

3. Morphological classification:

The crude drugs are grouped according to the parts of plants and animal represented in to organized and unorganized drugs. The roganised drugs are dried latex, gums, extract etc. Some of the example of the crude dyes are as follows.

**Seeds**- Nux-vomia, straphanthus, Isabgol and castor.

**Leaves**—Senna, digitalis, vasaka and eucalyptus
Barks - Chinchonna, krchi, chinnamon and quaillaia.

Woods - Red sanders, Quassia, Sandalwood and sassafras

Roots - Rauwolfia, Ipecacuanha, Aconite and Jalap

Rhizomes – Termeric, ginger, valerian and podophyllum.

Flowers - clove, pyrethrum, Artemisia and saffron.

Fruits – Coriender, colocynth, fennel and bael.

Entire drug – ephedra, ergot, cantharides and belladonna.

Dried lattices – opium, gutta-percha and papain

Resin and resins combination – Balsam of tolu, myrrh, asafotida and bezoin

Dried juice - aloes, kino and red gum.

Gums - acasia, tragacanth, ghatti gum, gaur gum.

Dried extract – Gelatin, catechu, agar and curare.

This system of medicine is more convenient for practical study especially when the chemical nature of the drug is not clearly understood.

4. Chemical classification

The crude drugs are classified into different groups according to the chemical nature of their important content. Since the pharmacology activity and therapeutic significance of crude drugs are based on the nature of their chemical constituents. It would appered that chemical classification of crude drugs is preferred method for study. The crude drugs contains alkaloids are grouped together, apart from their taxonomical and morphological relationship. Some examples of chemical classification are as follows-

Glycosides- Digitalis, Senna, Cascara, and Liquorice.

Alkaloids- Nux-vominca-Ergot, Chinchina and Datura.
Tannins - Myrobalan, Pale-catechu and Ashoka

Volatile oils – Peppermint, Cloves, Eucalyptus and Garlic.

Lipids – Castor oil, Bees wax, Lanoline, Cod liver oil and kokum butter.

Carbohydrates and derived products – Acacia, Agar, Gaur gum, Pectin, Honey, and Isapgol.

Resins and resin combinations – Colophony, Jalap and Balsam of Tolu.

Vitamins and hormones – Yeast, Shark liver oils, Oxytocin and Insulin.

Proteins and enzymes – Casien, Gelatin, Papain, Tyrosine.

The crude drugs belonging to different morphological or taxonomical categories may be brought together, provided there is some similarity in the chemical nature of the active principles.

5. Pharmological (therapeutic) classification.

This classification involves grouping of crude drugs according to the pharmological action of their chief active constituents and their therapeutic uses. In spite of the chemical relationship and morphology taxonomical status or the drugs are grouped together, provided they exhibit similar pharmological action. Therefore Senna, Cascara, Castor oil, Jalap, and Colocynth are grouped together as purgatives or laxatives because of their common pharmological action. Similarly Gentian, Chinchona, Nux-Vomica and Swertia are grouped as bitters. The drugs differing in the mechanism of action, but with same pharmological effects are grouped together. e.g. bulk-purgatives, irritant purgatives, emollient purgatives, etc. Some of the drugs can be classified under two pharmological headings, since they exhibit two different actions. For example, Chinchona is classified as both, anti-malarial and bitter tonic.

6. Chemotaxonomical Classification

The expanding knowledge of phytochemical screening has revealed the existence of close relationship between constituents of the plants and their taxonomical status. The
‘Chemotaxonomy’ has brought the plant chemist back to the systematic botany in view of the fact that certain compounds have been found to characterize certain grouping. Chemotaxonomy establishes a relationship between the position of the plant and attempts to utilize chemical facts for more exact understanding of the biological evolution and relationships. The characters more often studied in chemotaxonomy, are secondary metabolites of pharmaceutical significance such as alkaloids, glycosides, flavanoids etc.. The knowledge of chemotaxonomy could serve as the basis of classification of crude drugs. The location of berberine alkaloid in Hydrasis, Berberis, and Argemon, distribution of rutin, ranunculacious alkaloids, and flavonoids in species of higher plants are of chemotaxonomical significance. DNA hybridization, amino acid sequencing in proteins and serotaxonomy are also gaining significance in this method of classification.

RE-ESTABLISHMENT OF TRADITIONAL MEDICINES.

Now-a-days there is renewed interest in the rational medicine. During the past of decade, there has an ever –increasing demand specially from the developed countries for more and more plant drugs containing medicinally useful alkaloids, polyphenolics, glycosides, steroids, and terpenoids derivatives. The revival of interest in natural drugs specially derived from the plants. It has been started mainly because of the widespread belief that “green medicine” is healthier than synthetic products. This has led to the rapid spurt of demand for health products like herbal teas, ginseng etc. during the 1980’s. Similar tendency has been shown towards a general increasing preference in the utilization of natural flavours, dyes, preservatives etc. rather than the less expensive synthetics.

STANDARDIZATION OF HERBAL MEDICINE

According to WHO, medicinal plants would be the best source to obtained drugs. About 80% of the individuals are using the traditional medicine throughout the world. However such medicinal plants should be investigated to better understand their properties, safety and efficiency.
The meaning of standardization is any set of condition that explain ideal, normal or desired state of something and that can be used as a means to keep of one shape and size i.e .to achieve a consistency in quality.It is very long process and there is no accepted pathway for achieving standardization .But standardization of the plant based medicine is through by many of the steps described as follows-

**Step-I**

There are some preliminary stages which are includes the decision making diseases are of interest or which plants are of interest teams .Following decision and ethanobotanical and a literature suvery is done in this phase where in an information is required on

- Uses of plants of interest claimed by folk healers and written down in ancient text.
- Parts of the plants used
- Methods of preparations
- Modes of adminstration of medicines
- Diseases conditions and patient condition for which the medicines are effective.
- Season of collection and time of collection of plant.
- If possible arbitrary does of the medicine used.

In addition to the above information field survey also carried out to find out which other species co -occur so that their effects Physiology can be collected and if the species are harmful, methods would have to be developed to check their presence during the collection of raw material.

The next step to be taken should be to establish the botanical authenticity of the species. Herbarium sheets should be prepared to serve as a cross check for others .During this time the animal model for the testing the effect of the species should be developed. This phase is also include acute toxicity of possible contaminants .The
species which co-occurs and hence would find them in the raw materials. This phase would include the general methods to access the quality of the wrong materials, such as extractive value from various solvents, total alkaloid content, total flavonoid content etc. The effectiveness of the plant species would be tested keeping the form of medicine as used by the folk healer. This phase would further include developing finger print pattern for the species and developing methods to be established the presence of contaminants and adulterant in the raw material especially they are toxic.

**Step –II**

The step two having established that the plant is effective. This phase includes fractionisation. The activity of the plant further investigated so as to narrow down the activity to the particular phytochemicals. Having done so, the structural elucidation of the phytochemicals in a active extract is also carried out. The purified phytochemicals can now be used to develop specific methods to determine the quality of the raw material. Having developed quantitative methods, variability in the plant’s active constituents due to the age of plants at the time of harvesting, season during which the plant was collected, locality from which the plant was collected is studies during this stage. The study can also be carried out at this stage to assess the stability of the raw material w.r.t. the quantity of active ingredients to predict the shelf life of material.

**Step-III**

The availability of the standard renders further work possible in this phase. In this phase, the pharmacokinetics of the original medicine can be carried out in human volunteers. Folk healers and practitioners of traditional therapies are asked to write down detailed reports whenever they use plants. This would provide information on the action of the plant on human patients. Simultaneous trials (naturalistic) are carried out by the practitioners of modern medicine using standardized original formulation.

**Step-IV**

The original formulation is effective. The absorption, distribution, metabolism and the excretion profile (A.D.M.E.) of the medicine in this phase includes double blind clinical
trials. The medicines are made suitable to modern needs by developing their capsules, syrups etc. Studies are again carried out on these modern versions. Herbal medicines are more compatible biologically with biological systems and generally have minimal toxic effects as compared to allopathic drugs. The availability of herbal medicines is more as they derived from renewable sources. They can also be cultivated and are open to afforestation projects. Herbal medicines can be developed at low cost as compared to the synthetic drugs. Herbal medicines always compliment the conventional treatments, providing safe, well tolerated remedies for chronic illness.

SIGNIFICANCE OF PHARMOCOLOGY AND TOXICOLOGY IN STANDARDIZATION OF HERBAL MEDICINES

A drug is broadly defined as any chemical agent that affects processes of living. Pharmocology is connected primarily with drugs that are useful in the prevention, diagnosis and treatment of human diseases. Pharmocology embraces the knowledge of the history, source, physical and chemical properties, biochemical and physiological effects, mechanism of action, absorption, distribution, biotransformation and excretion, therapeutic and other uses of drugs. The relationship between the dose of a drug given to a patient and the utility of that drug in treating the patient’s disease is described by two basic areas of pharmacology 1) Pharmacokinetics 2) Pharmacodynamics. In short, these terms may be defined as what the body does to the drug (Pharmacokinetics) and what the drug does to the body (Pharmacodynamics)

Pharmacokinetics deals with the absorption, distribution biotransformation and excretion of drugs. These factors help in determining the dosage of the drug, concentration of a drug at its sites of action and the intensity of its effects as a function of time. The basic principles of biochemistry, enzymology, physical and chemical properties that govern the active and passive transfer and distribution of drug across biological membranes are applied to understand this important aspect of pharmacology. The study of biochemical and physiological effects of drugs and their mechanisms of action is termed pharmacodynamics. Pharmacodynamics involves theoretical knowledge and experimental techniques of physiology, biochemistry, celluar and molecular biology,
microbiology, immunology, genetics and pathology. It is mainly concerned with the characteristics of drugs.

World health organization (WHO) supports appropriate use of herbal medicines and encourages the use of remedies that have proved safe and effective. Most herbal medicines need to be studied scientifically, though the experience obtained from their use over the years cannot be ignored. Very few herbal medicines have withstood scientific testing e.g. Turmeric, Neem, Tulsi, Brahmi, Gulavel etc. Others are simply used for traditional reasons to protect, restore or improve health. There is a need for scientifically verifying the validity of herbal products for their safety and therapeutic efficacy. This undertaking involves the teamwork of phytochemists, toxicologists and pharmacologists.

SAFETY AND SIGNIFICANCE OF HERBAL DRUGS

The aspect of safety is pharmacology that deals with the unfavorable effects of drugs. The adverse effects of the drugs employed in therapy are considered as an integral part of their total pharmacology. Frequently the term natural and pure are used as synonymous with safe. The wrong notion comes in the mind of the many people that if it is doesn’t cure, it also doesn’t hurt. One of the examples of plants with long term toxic effects is glycrrhiza glabra rhizome which is used as an anticular drug. But the major alkaloid glycrrhizin was found to disturb the mineralocorticoid balance in the system and its long-term use was found to unsafe.

Currently deglycerrhizinated liquorice is used in peptic ulcer therapy without any untoward side effects. The Food and Drug Administration (FDA) regulates drugs, medical devices, cosmetics, and food additives. For food additives, the FDA attempts to determine the acceptable daily intake (ADI) that can be consumed over an entire lifetime without any appreciable risk. The Environment Protection Agency (EPA) is responsible for regulation of pesticides, toxic chemicals, hazardous wastes and toxic pollutants in water and air. The Occupational Safety and Health Administration (OSHA) determine whether or not employers are providing working conditions that are safe for employees. The employers must keep the concentration of each chemical in the air of
the workplace below a Threshold Limit Value (TLV). The Consumer Products Safety Commision (CPSC) regulates all articles sold for use in homes, in schools or for recreation, except those products regulated by the FDA and the EPA. Two specialized areas of toxicology are particularly important for medicine, namely, forensic and clinical. Forensic toxicology, which combines analytical chemistry and fundamental toxicology, is concerned with the medicolegal aspects of chemicals. Clinical toxicology focuses on diseases that are caused by toxic substances. Clinical toxicologists treat patients who are poisoned by drugs and other chemicals and develop new techniques for the diagnosis and treatment of such intoxications.

Evaluation of dose-response or the dose-effect relationship is important to toxicologists. There is a graded dose-response relationship in an individual and a quantal dose-response relationship in the population. Graded doses of a drug given to an individual usually result in a greater magnitude of response as the dose is increased. In a quantal dose response

In various society and folk region the different types of herbal medicines are accessible. These medicines are traditionally accepted by the people because of its availability, low cost and effectiveness. The herbal medicine can meet up and satisfied the requirement of primary health care. Predominantly in remote and rural places which are very far away from the city and couldn’t get any facilities of health treatment.

In many countries the accessible territory supported projects on traditional are performed which play an important role in the health care awareness and treatment. These projects are good complements to recent pharmaceutical medicines and their development.

From the different communities the knowledge about the herbal medicine and their application in various diseases should be combined together. The communication in various communities and groups of people is very desirable. From various communities the plant should be selected which are having medicinal importance. The plants should be easily available in the local area of the community. The selected plant should be useful in the treatment various disorder. It should have effectiveness and safety for use.
To create awareness among people the learning and education supplies on these selected plants should be arranged and spread.

Group of people and health human resources should be skilled in the recognition, compilation, handing out, utilization and for storage of medicinal plants like herbs and plants. Local people should be confident for the plantation of medicinal plants in their farms and garden. Through the plantation the awareness can be created among the people.

The practices of herbal medicine should be synchronized and incorporated in the health care system of the countries. On the basis primary, secondary and tertiary levels workings of health care should be organized. The encouragement of the countries should be known about the current expansion and progress in herbal medicine throughout the world. The herbal medicine should be adopted in various types of treatments and beneficial to societies.

**Policy of herbal medicine defines by World health organization.**

The world health organization has been aware about the herbal medicinal plants because of the medicinal importance and therapeutically potential of plants. This organization is connected with the many states of the countries all over the world and supports the products and herbal plants.

Initially in the year of 1978 the governing body of the World Health organization the WHO governing body, accepted a declaration of policy on drug, medicinal plants management documented and understood the significance of herbal medicinal plants in the system of health care.

The assembly of World Health organization planned and synchronizes the hard work during the research of an inventory of medicinal plants. The methods and criteria of development for improving and verifying the protection and efficiency of medicinal plant products and the propagation of applicable information.

From year 1987 to 1989, more declaration was accepted for the recognition, valuation, research, gardening, consumption, guideline and protection of herbal medicinal plants.
On the basis of decision, the world health organization policy on herbal medicine may be review as follows:

- World health organization is completely conscious about the significance of herbal medicines for the treatment of various diseases and health disorder of human in the world.

- Herbal medicines are recognized as precious and easily available resources, and their suitable use is expectant;

- The proper use of medicinal plants and a wide-ranging agenda for their classification, estimation, research, agriculture, detection should be encouraged;

- It is essential to create a regular catalog and evaluation reports of medicinal. The measures on the rules and guideline of herbal medicines should be introduced.

- The guarantee about the superiority control of herbal products by using advanced techniques and application of suitable principles and good quality manufacturing practices and contribution of herbal medicines in the nationwide standard.

- Since a lot of herbal plants supply conventional and advanced medicines are in danger with disappearance. World health organization taking the support of international cooperation. It has been coordinated with various countries to arrange the awareness programs for the conservation and presentation of medicinal plants and making availability of such medicinal plants for future generations.
National organization body for herbal formulated medicine:

An appropriate national body should be established to coordinate for the development of programs on the basis of herbal medicines. This body should be responsible for describing the national strategy and policy. It will be helpful for interpreting it into an action plan. Its work should be related to the different agencies which are present in all over the world. Herbal medicine national management body should synchronize the execution in various sectors and interdisciplinary actions of herbal medicine.

The advice and suggestions should be provided by the national body to policy maker. The national body should sure about the adopted policy and strategy and action plans of the programs and should be explained into set activities at various stages.

For proving the recommendation, advice and suggestions an advisory committee should be established. For implementation of the national herbal medicine program a national network should be established for supporting national body work.

Need of strategy on suitable use of herbal medicines:

Mainly Herbal medicines useful by conventional system of medicine from the thousands of years. Experimental knowledge put up over from many years that offers a significant base for the safe and efficient use of herbal medicines. Not only in main form of treatment, but also in western medical treatment for many diseases and disorder. Herbal medicines are easily available, handy, reasonable, ethnically suitable and sustainable in developing countries than western medicines. Recently in developed countries, the status of herbal medicines is growing for the treatment of certain types of ailment.

Herbal medicines are not always safe because some of them cause the harmful and adverse effect. Since they are natural, a few of them have causes carcinogenicity and hepatotoxicity side effects due to the severe unfavorable reactions of chemicals present in it. The use of herbal medicines will be useful when they are used properly. So regularity of herbal medicines and high quality control are necessary. In addition due to
the improved use of herbal medicines as well as modern pharmaceutical medicines, it is need to supervise communications.

Due to rising popularity and attractiveness of herbal medicines, many countries are interested in developing the herbal medicine in health care system, promotion and receiving technical supports. It established well-built foundation for the future expansion of herbal medicines in health care systems of every country in the world. The organization of herbal medicine and utilization of plants are differing in different countries in the world. For the suitable use of herbal medicines, these guidelines are helpful.

Many alkaloids show different types of structures with pharmacological properties with anti microbial property. (Ahmad et al; 1987). In nature various types of medicinally useful plants are present. Near about 500 natural dye or colorants yielding plant has gifted from nature. (Krishnamurthy K, et al; 2002) and medicinal plants also has a great demand in a variety of industries. Among yielding plant, species, play vital role in medicine which are environmental benign in nature. Because of medicinal properties of *solanum xanthocarpum*, people are using this plant to cure different types of disorders.

**Properties of solanaum xanthocarpum:**

1] Solanum xanthocarpum showed antimicrobial activity. (Rajkumar et al 2010)
2] It showed antibacterial activity. (Sheeba E; 2009)
3] Methanolic extract of fruit showed the moderate capability to protect the cell. This showed antioxidant activity.
7] Solanum xanthocapum constituents showed anti viral and anti microbial activities. (Malik F.et al; 2011)  
8] Aqueous extract of herb gives stigma sterol and beta sitosterol showed immunomodulatory action. (Kannam et al; 2012)  
9] It was investigated that gylcoalkloids with alkaloid solasodine effect on tissue culture.

Different parts of solanum xanthocarpum are the source of various useful chemical compounds. Purple colored flowers are very attractive in colors. The green and yellow dried fruits are contains solanocarpine alkaloids (Mahanta D et al; 2005), solanacarpidine, solancarpine, solasodine, solasonine (Gupta MP et al.; 1938). It also contains solamargine alkaloids and caffic acids (siddhiqui, S.1983 and Tupkari,S.et al 1972). Coumarines like aesculetin and aesculin are also present in solanum xanthocarpum (Kumar,A.et al;2009).Kusano reported that it contains carpesterol,steroids ,disgenin and tripentenes in fruit of solanum xanhocarpum (Kusano G et al;1973). Solasodine alkaloid present in Solanum xanthocarpum fruit shows antispermatogenic activity (Dixit V P et al; 1986).Due to the therapeutic activities, natural products has great importance from ancient time. Minerals, medicinal plants and animal were the main sources of medicine. The leaves contains phyto constituent like alkaloids, tannins, glycoalkaloids, proteins, flavonoids, carbohydrates, fats and phenolic compounds (Hernandez et al; 2002).

Roots are well known in Ayurveda for the preparation of “Dasmulasava”. It is used in treatment of cough and asthma. It is also wellknown for expectorant and chest pain in Ayurvedic medicine. Apigenin was obtained from petals of flowers. Quercetin and sitosterol were ontained from stamens of flowers. The fruits stem and purple coloured flowers are useful in the treatment of to get relief from buring sensation of feet. The activities like antitumor, antifungal, cytotoxic activities, hypotensive and antianaphylactic, antibacterial, antifertility, antidyslipidemic, antifungal activities are also reported (Singh S.P et al;2001).

Leaves in the form of aqueous extract show asthelmintic and astringent property and used to apply on forehead to get rid of pain from headache.

It also possesses aphrodisiacs, laxative, diuretic, stomachic cardiotonic and refrigerant activities (Duraipandiyan V, et al; 2006). The solvent extract and aqueous extract of fruits shows anthemintic activity of parasites (Gunaselvi. G, et al; 2010) Due to nutritional values, cost-effective and therapeutic, and , the importance of solanum xanthocarpum has been increasing in our society. It uses in treatment of skin ailments for wound. (Govindan et al; 1999).

Such plants were chosen for the analysis of their contents and constituent. This is very important to mark the physical effect on living organism by the use significant content of the plants. It has reported from the ancient time that pigments from the nature are very important for the medicine. In pharmaceutical industry, cosmetics, food and textile industries plants has a great demand. There are many sources are available for the dyes. Dyes can be obtained from plants, insects minerals as well as from the vegetables. The extracted dyes from these sources are very valuable because of their medicinal properties.
The natural products are very famous for their great medicinal values. Our nature is a gift of natural products, medicine, beautiful colourants and pigments. In various fields of textile and food, natural colourants are being used due to the safety and ecofriendly nature of the dyes. For the formulation of advance medicine the natural product has a great demand. Due to the healing properties and medicinal potential, the alkaloids are very beneficial in pharmaceutical field.

It is very much beneficial for human being as well as animals as in the form of food, fodder for animals and medicine for folk. It can be used in crude form in any application. It is also useful for formulation. But it is also dangerous because of toxic nature of the plants. The exterior and interior uses of plants have a major aspect in medicine practices. The use of the traditional medicines in different regions is because of the experience and knowledge obtained. Now a days natural dyes are also extracted from some medicinal plants. Worldwide, natural dyes are source of income due to beneficial properties. Natural colour dyed textiles gives priority for use in the textile industry with a growing need for finding suitable and less hazardous dyes. Natural dyes extracted plants have large demand in textiles industry as well as in medical, food, leather, cosmetics and pharmaceuticals. Natural dyes are becomes attractive alternatives to the synthetic dyes. The excessive use of synthetic dyes released large amount of waste material and unfixed colourant. This waste material disturbed the ecology and ecosystem and causes health hazards for living organisms. Hence need to intervened vegetative colour for the appellation to the green minded consumer. Yet there is no attention towards dyes of aerial part of plant except flowers and extraction of alkaloids from leaves hence the Solanum xanthocarpum is selected for the study.

1.1 FAMILY SOLANACEAE:

The Solanaceae is a cosmopolitan family and derived from the genus Solanum. It is worldwide distributed throughout tropical and moderate regions. The diversity centers are in some part of Australia and America. This family consists of around 98 genera and 2700 species. Solanaceae is derived from solanum Latin word means nightshade plant. Its origin is from solari Latin verb. The meaning of solari word is soothe. Some
So soothing pharmacological properties have been found in the solanaceae family. It has attractive coloured flowers and fruits. The solanaceae family contains various types of the plants which are economical and flowering plants. The range of the plants is from annual to perennial. The herbs, shrub and trees, vines epiphytes and lianas are present in solanaceae family. In agriculture various types of the crops are from the same family. The weeds, spices, ornamentals plants and medicinal plants are also included in this family. The number of the members of the solanaceae family grows climbing or in erect position and shrubs are not found commonly.

In spite of this enormous prosperity of genus but not uniformly distributed though out the genera. In solanaceae family eight genera are found named as Brunfelsia Physalis, Lycium Solanum, Lycianthes Cestrum, Nolana, Nicotiana, Brunfelsia. These eight genera contains more than 60% of different types of species. The meaning of the solanum is sunberry.

In Solanaceae family a range of products are obtained which are having cooking, therapeutic and decorative ethics. The culinary importance of Solanaceae family is very significant. Some of the species from this family use as global diet. Solanum tuberosum or potatoes are very rich carbohydrate and widely used as food for its taste and richness of carbohydrates. Some other fruits and spices like chili pepper, tomatoes, eggplants, uchuva, tomatillos and peppers are used in food (Farhana M et al; 2014). Most of the members of solanaceae family are used because for their therapeutically properties and some of them are toxic in nature. Some plants shows psychotropic effects.

Solanaceae includes many members which contains alkaloids and therefore are wellknown in history for their medicinal importance and value. Important drug plants include Datura stramonium. It is called as jimson weed. Though Datura stramonium is traditionally useful but also known for the witchcraft. It is rich source of scopolamine and alkaloids. Both having the potent of hallucinogens. It has reported for the accidental poisoning, intoxication and even causes the death. The active constituents like meteloidine, apohyoscine and scopolamine and atropine and hyoscyamine are found in Datura stramonium. A great diversity of habitat as well as ecology is found for this family.
From solanaceae family many plants are toxic in nature and some of the plants contain alkaloids which are having medicinal importance. *Solanum xanthocarpum* belongs to the Solanaceae family. It is called as yellow berried nightshade and it is also known by the other name Indian nightshade. It is occurs in bare land or road side and railway side places in India. This herb is a perennial herbaceous weed. Different parts of this plant are very useful in the treatment of fever, cough, diabetes, toothache, constipation and asthma. From the ancient time the use of this plant is very beneficial traditionally for curing various diseases such as, cough, fever, asthma, toothache and diabetes in Indian traditional medicines.

*Solanum xanthocarpum* is commonly called as kantkari in sanskrit. Some other synonyms are nidigadhika, dhavani, duhsparsha, kantalika, kantakarika and vyaghri.

**Name of solanum xanthocarpum in different languages in India**

(Sharma N .et al; 2010).
<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Languages</th>
<th>Name</th>
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<tbody>
<tr>
<td>1</td>
<td>Sankrit</td>
<td>Kantakari</td>
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<tr>
<td>2</td>
<td>Marathi</td>
<td>Bhuiringani</td>
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<tr>
<td>3</td>
<td>Gujrathi</td>
<td>Bhoringni, Bhonya- ringani</td>
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<tr>
<td>4</td>
<td>Hindi</td>
<td>Kateli, Kattay</td>
</tr>
<tr>
<td>5</td>
<td>Telgu</td>
<td>Callamulaga, Pinnamulaka, Nelamulaka, Vakudu</td>
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<td>6</td>
<td>Malayalam</td>
<td>Kantankattiti Kantkariccuta, Kantkarivalutana</td>
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<td>7</td>
<td>Kannad</td>
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<td>8</td>
<td>Marwari</td>
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<td>9</td>
<td>Oriya</td>
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<td>10</td>
<td>Punjab</td>
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<td>11</td>
<td>Bihar</td>
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</table>

**Local Names:** The regional name of *Solanum xanthocarpum* in India. The local name is very important for the identification of the medicinal plants which are present in different region.

- **Assam:** Katvaedana, Kantakar
- **Bengali:** Kantakari
- **Punjabi:** Kandiari
- **Tamil:** Kandangatri, Kandan Katri, Kandanghathiri
- **Telugu:** Pinnamulaka, Mulaka, Chinnamulaka Nelamulaka, Vakudu
- **English:** Febrifuge Plant
- **Kannad:** Nelagulla, Kiragulla
- **Malayam:** Kantakari Chunda
- **Marathi:** Bhauringani, Kataringani
- **Orissa:** Ankarati, Chakada Bhaji Bhejiaugana, Ankarati, Chakada Bhaji
- **Gujarati:** Bhoringani
Hindi: Bhatakataiya, Chhotikateri Katai, Katali, Ringani

**Ayurvedic classification:**

In Ayurveda there is great importance for medicinal plants. Various plants are used for many formulations for drugs. Solanum xanthocarpum also having great importance in Ayurveda. Solanum xanthocarpum is commonly called as kantkari. This plant is categorized under ten drugs like Kasahara, Kantya, Sheetaprasamana, dasemaanis, Sotha hara, Hikka nigrahana, Anga marda prasamana. This plant use in the treatment of cough, fever, bronchial asthma called in Ayurveda as kasa, jwara and shwasa respectively. In Ayurveda it has been reported for the treatment of respiratory diseases (charaka; 1994).

**Habitat and herbarium:**

**Habitat:**

It is a spiny herb and diffuse mostly found in different parts throughout different states of India. In Maharashtra, west Bengal utter Pradesh, Bihar and some other states the solanum xanthocarpum grows in waste land area. The habitat is found near the railway track and on bare land. It is found everywhere like bank of river, farm, garden and mountainous area.

**Harbarium:**

Dasmula has great impotance in Ayurveda, solanum xanthocarpum is one of them. This herb is a spiny diffuse with zigzag branches and found in different regions of India. It is up to 1.5 m in height. Different parts of this herb are very beneficial. In sore throat treatment the juice of berries is very useful. The paste of green leaves is applied to get relief from pain and snake bite. The aerial parts like fruits, leaves and stem are bitter in taste. They are very carminative. The purple coloured flowers are very attractive and used for decoration also. As this plant is very useful because of its medicinal properties but its cultivation is not done in systematic way.

**Plant description:**
Solanum xanthocarpum is weedland plant with zigzag spiny alternate leaves branches. The flower having five petals and form conical shape or funnel shape when petals get fused.

**Species and other things:**
According to literature data, it was observed that many researchers worked on fruit of *Solanum xanthocarpum* plant. Solasodine alkaloid is present in fruit of *solanum xanthocarpum*.

**Life cycle:**
It has terrestrial life cycle with various life span, and overall height.

**Climate:**
It required sunshine, water, optimal soil texture acceptable soil pH. The special soil type is not requiring for the growth.

**Herbal medicine and its popularity:**

Now a day herbal medicines are accepted as an alternative of allopathic medicines because following positive reasons:

- The cost of the allopathy medicine has been increasing day by day.
- Herbal medicines are easily available and low in cost as compare to allopathy Medicine.
- Herbal medicine prepared from the natural sources and has no side effects.
- Herbal medicines cure various types of the disorders. Because of its positive effects in the treatments, it has been favorable.
- Availability of herbal medicines has become very easy and very economical.
- Herbal drugs can be easily stored.
- These medicines remove the infections from the root and never occur the infections over again.

*Solanum xanthocarpum* has many medicinal properties. Leaves, seeds and roots are used for various treatments for the ancient time.
The another variety of this plant has also white flower. Such type is called as Laxmana. But its occurrence is very rare. It is helpful to post digestive effect and has hot potency effect. Fruits are used in the treatment of toothache, indigestion and anathematic. Fruits are used to clear the infections from teeth and acts as a pain killer. In Ayurvedic medicine for the treatment of cough, asthma, flatulence, sore throat, as well as chest pain roots of the plant are an expectorant. The high concentration of alkaloid solasodine is present in *Solanum xanthocarpum*. In the manufacturing sex harmones and cortisone solasodine is used. It promotes conception in women. Dried fruit aqueous extract is used in the treatment of cough fever and heart. The dried fruits hot aqueous extract is used in treatment of fever, cough and heart diseases. Due to its medicinal properties, it is reported for the many pharmacological treatment.

**Ayurvedic Properties:**

Violet, yellow and white colored flowers are occurs in *Solanum xanthocarpum* plant. It improve vata and kapha from the body. It is beneficial to reduce the effects of worm and effectively control asthma and cough. All parts of the plants are useful in various treatments of diseases. Fruits help in ejaculation worms and reduce fat of the body itching and fever. The traditional use of the fruits in the treatment of diabetes has been reported steroidal saponins. The total extract of plant has been mentioned to exhibit potent antistress adaptogenic effects.

**Application of solanum xanthocapum in formulation of medicine:**

*Solanum xanthocapum* is use as important ingredient in formulation of Ayurvedic drugs like chavanaprasha, dasamoolarishta, Vyaghriyadi kwatha Vyaghriharitaki Vyaghri ghrtam, Vyaghri tailam, Vyaghriharitaki avaleha. The whole plant of kantkari is use in various treatment like vata, kapha, flatulence, inflammations and skin diseases.

It is also used for the remedy of hypertension, fever, and cough. In the treatment of asthma, lumbago, haemorrhoids, bronchitis, hiccough, and epilepsy kantkari is useful. In dental problems, leprosy, constipation, dyspepsia and helminthias kantkari having
many applications. The application of solanum xanthocarpum are well known in various field.

**Application in Ayurveda:**

The therapeutic activities of solanum xanthocarpum are mentioned following in Ayurvedic terms. (The Ayurvedic Pharmacopoeia; 2001)

- Pain reliever property is called as vedana sthapana
- Aphrodisiac property is term as Vajikarana.
- Anti-pyretic property is called as Jwaraghnna
- Swelling reducing property is called as Shothahara.
- Sweating increasing property known as Swedajanana
- Appetizer activity called as Deepana
- Cough reliever property called as Kasahara.
- Purgative property called as Rechana.
- Blood purifier property is tem as Raktashodhaka.

**Special qualities:** It has tolerated drought, no tolerate high humidity and seaside conditions. There are no insect resistant.

**Curative application:** Solanum xanthocarpum use din the treatment of fever. Specially uses in the treatment of cough and cold. Every part of plant is very important in curative action of various disorders. Stem and flowers are used for treatment of feet burning sensation.
The warm aqueous extract of dehydrated fruits is beneficial to cure heart diseases, fever and cough. The Berries of the plant are wellknown from the ancient time for its medicinal uses. It is useful in the preparation of contraceptive medicine for female. For the swelling and pimples treatment the paste of the fruit is applicable. The fruit possess some therapeutic properties like anti tumor, antipyretic, antiplasmotic and anti-inflammatory. The fruit juice is used for the treatment of rheumatism and sore throat treatment. The anti-tussive powder is used in asthma and cough. The roots of solanum xanthocarpum are used in chest pain treatment.

In Ayurveda solanum xanthocarpum known for the shwasahara and jwarahara. as well as kasahara doses. For the small children its doses are very beneficial and curative. In blood purification and pneumonia solanum xanthocapum is useful. In the nasal drops solanum leaves of the plants are used. Now a day in the treatment of hair and dandruff the plant extract is used. Solanum xanthocarpum is considered as an herbal remedy like carminative and an expectorant. It is only use with suitable expert understanding. The leaves together with the seeds and the root are measured to be the precious parts by the herbalist. Solasodine is main source of alkaloid from fruit of solanum xanthocarpum which shows pharmacological activities like antifungal and antimicrobial activity. It was affected on the functions as well as synthesis of genetic substances in P. wickerhamii and S. cerevisiae. The growth of larva was repressed with solasodin content diet. It has reported that different types of constituents are present in this plant like glyco alkaloids like solanine, solasodine, solamargine solacarpine cholesterol, glycoside, amino acid, carbohydrate apigenin and coumarines.

**Cultivation:**

For cultivation of *Solanum xanthocarpum* various pollination methods are used. Planting style, crop spacing, row spacing and warm heat is required. The typical time is required for the harvestment of the plant. No special treatment is required the plantation. It required bare land and waste land for the growth. Special care and manure is not required. The cultivation method is very easy for solanum xanthocarpum. From the pollination process the quantity of plants can be increases.

Due to the attractive purple colours of flowers and green leaves these are looks very beautiful on water land or bareland.
**NUTRIENT COMPOSITION:** The various constituents like carbohydrates, fatty acids, sterol and amino acids are present. It contains carpesteral and alkaloids like solanidine, solamargine, solanine and solacarpine etc. The presence of such main constituent, the nutritional value of the plant is increases.

**APPLICATION:**
Medicinal plants have been used to cure diseases since the ancient time throughout the world. Plants are the important major sources of drug in modern as well as traditional medicine. The various bioactive substances in plants are produced as secondary metabolites. Its constituent’s vitamin C, anthocyanin, solasonine, proteins, carbohydrates and many more phytocompounds were also reported in *Solanum xanthocarpum*.

The aqueous and alcoholic extracts of the plant showed, antiviral activity and hypotensive effect against Ranikhet disease virus and also against sarcoma 180 in mice. The parts of *Solanum xanthocarpum* plants are used for various purposes.

**FLOWERS:**
These are specially used for decoration. The flowers are used for dying and fragrance due to its diversified beautiful colours. Specialy white flowered *solanum xanthocarpum* known as lakshmana and used to promote conception in women. It also used as blood purifier and in stimulation of heart. It is very effective in the treatment of edema.

**ROOTS:**
The juice of root is externally used in the form of vyaghri taila through nostrils. It is useful in the treatment of sinuses. It is also useful in the treatment of headache, migraine and asthma. Its medical ingredient has been used in Ayurvedic medicine for relieving common disorders and to relieve problems of scorpion and snake bites.
A paste made from root along with lemon juice use to appy on the affected part of human body. A variety of experimental studied showed that the plant possesses antibacterial benefits. It relieves various problems of bronchial asthma, bronchitis, and chronic cough. It is useful in acute cases of gastrointestinal problems because of its laxative and carminative nature. The root juice of solanum xanthocarpum is also very beneficial and useful in the abortion. It has been applicable for curing various types of ailments from the ancient periods.

**FRUITS:** From the ancient time folk people uses the dry fruits of solanum xanthocarpum for smoking like cigarette. The fruits are very rich in alkaloids like solasodine. It removes the infection from the teeth by holding smoke of fruit in mouth. In the treatment of piles and sore throat the juice of fruit is very beneficial and in the treatment of pimples the paste of fruit is used. Fruits are useful in piles treatment and decoction. It is beneficial on cough and cold. The paste of leaves is use to apply on body to get relief from body pain.

This herb is also useful in the treatment of snake bile. Fruits also have chemical constituents such as coumarins, solasodine, aesculetin (Kusano et al; 1973). It is also contains daucosterol, triterpenes like cycloartanol, caffeic acid (kumar A.G et al; 2009), carpesterol are also present in the fruit of solanum xanthocarpum which enhance value of the plant though it is waste land weed. Many of its formulation made along with honey, tulsi, and black pepper to promote conception in women. The different parts of solanum xanthocarpum are very beneficial.

**Toxicology:** The toxicity and any type of adverse effect were not reported for the herb solanum xanthocarpum as it is used as medicine.

**Phytochemistry:**

Fruit of solanum xanthocarpum contains glycoalkaloids. Kanga and Saiyed in 1936 isolated the material carpesterol all along with a glycoside and alkamine afterward recognized as solasodine and solasonine. Successive study of extract from solanum xanthocarpum prove the occurrence of diosgenin and β-sitosterol. The high concentration of alkaloids solasodinelIt is use as a initial material for the produce
cortisone and sex hormones (Bector and Puri., 1971; Tupkari et al., 1972; Govindan et al., 2004). The phytoactive compounds extracted from this plant which consist of solanocarpine, solanocarpidine, diosgenin, carpesterol, sitosterol and steroids (Josekutty., 1998).

**History of alkaloids:**

The isolation of alkaloids from the nineteenth century is continuously going on. From that time the alkaloids are using for the various types of treatment of disorder. The isolated medicine and drugs are very useful in the treatment of diseases. Now a day there is great importance for the medicine and drugs obtained from the plants. In 1803 narcotine alkaloid was extracted by the French apothecary Derosne. In the further investigation Hanoverian apothecary Sertürner studied opium and isolated alkaloid morphine. Pelletier and Caventou isolated various types of alkaloids rapidly. The alkaloids like Strychnine was isolated in 1817. In 1819 the alkaloid piperine was isolated. In the same year brucine and caffeine were isolated. Quinine and colchicines were isolated in 1820. Coniine was isolated in 1826. Coniine was the first alkaloid which structure was established.

The new modern methods and instrumentation methods are very much make possible these investigations. It is very much interesting to make a note that the yield of minor alkaloids is very less in quantity for the further investigation small for further investigation. During the first quarter of the last century chemists are sufficient, they were tried thousands of efforts for the analysis and structure analysis.

In 20th century, many efforts were taken by the researcher for the drug and structure analysis of alkaloids. Many of them studied the anti cancer activity form the alkaloids. A distinguished achievement was the introduction of the alkaloid like *Catharanthus* and
paclitaxel into medication. Due to this there was a much interest in some other alkaloids which possess the anticancer properties and anti aging as well as antiviral potential.

**ALKALOIDS FROM SOLANUM XANTHOCARPUM:**

**TISSUE ALKALOIDS:**
Khanna reported that the hydrolysed base occurs in the tissue of *Solanum xanthocarpum*. Its fruits and leaves were also assayed for their alkaloid contact (Khanna et al.; 1976). Verbist and Monnet in 1974 compared the alkaloid constituents of *Solanum xanthocarpum* collected in Nepal and France. It was noted that the French fruit were richer in solasodine alkaloid than Nepalese fruit. The yield of solasodine in fruit of French plant was 4.6% and 1.6% was found in in Nepalese plant. They also found some traces of tomatidenol in both sources of plants (Verbist and Monnet; 1974).

**LEAVES ALKALOIDS:**
Tupkari et al. in 1972 isolated conmannns, scopoletin, eaculetin and their glycosides ecololin and esculin from dried aerial part like root, leaves and fruits of the plant.

**FLOWERS ALKALOIDS:**
Small and half ripe fruit shows white and greenish strips on it. Mature and riped fruit shows yellow and white strips. Fruit has characterised smell with bitter taste. Fruit contains many reniform and compressed seeds which are smooth in touch. In the transverse section it is observed that thin layer of cuticle is covered on epidermis layer. Flower alkaloids are very important in various disorder treatments. In 1978 Dubey and Gupta reported the isolation of Quercetin 3/-O-β glucopyranosyl o-β-D-mannopyranoside apigenin and sitosterol from flowers. In the synthesis of sex harmones and cortico steroids *solanum xanthocarpum* is used as starting material. Various groups of worker carried out biosynthetic studies to increase the production of secondary constituents of the plant.
Taxonomic classification of Solanum xanthocarpum:

**Synonyms:** Solanum virginianum Linn and Solanum surattense Burm.F

**Kingdom** of plant: plantae

**Genus** of plant: solanum

**Sub-kingdom of plant:** Tracheobionta

**Division of plant:** Magnoliophyta

**Class and subclass** of plant: Magnoliopsida asteridae

**Family** of plant: Solanaceae

**Order** of plant: Solanales

Morphology description of Solanum xanthocarpum used in present study:

**Leaves:** The leaves are green in colour elliptical or oblang wit subacute hairs. It is almost 4 – 12.5 cm in length and width is about 2 – 7.5 cm. The midrib and veins are with full sharp prickles.

**Fruits:** These are globular with the diameter of 0.8 – 1 cm and calyx at the base. Berries of the herb are green in colour with white stripes and mature fruits are yellow in colour, enclosed with calyx.

**Flowers:** they are bluish purple in colour, densely pricked with 0.5 – 1.3 cm in length. They have five stamens, glabrous, 1.5 cm filament, linear -lanceolate, superior ovary, calyx persistent, pedicellate, gamosepalous, and bisexual in nature. Lobes are acute hairy and deltoid while corolla is gamopetalleous.
**Stem:** Herb solanum xanthocarpum is diffuse, perennial, spiny and woody at base. Zigzag branches of the herb shows sharp yellow prickles on it there are presence of nodes and internodes. They are thin, green and covered with hairs in young branches. Mature stems are glabrous with the thickness of 8 – 10 mm having light green to yellowish colour and smooth surface. A centre is distinct and large having hollow pith.

**Seeds:** Seeds are numerous with the diameter of 0.2 cm. They are acrid and bitter in taste. Seeds are embedded in mesocarp which is fleshy in nature. They appear to be flat and circular.

**Roots:** roots are cylindrical and tapering at end. The length is 10 - 45 cm and diameter is about 2 cm. It possess fine tranverse and longitudinal wrinkles with small rootlets and lenticles. They are bitter in taste.
Figure 1.1: Image of Morphology of *Solanum xanthocarpum*.

Figure 1.2 A: Image of flowers of *Solanum xanthocarpum*.  
B: Image of *Solanum xanthocarpum* on bareland

**Geographical source:**

*Solanum xanthocarpum* is a waste land weed occurs throughout India in dry situations and in some other countries like Pakistan, shrilanka and Bangladesh, Asia, Malaya, Tropical, Auastrana, Ceylon and Polynessia etc. It is 2200 m in height on Himalaya(Sharma p c et al;2001). The growth of the plant is naturally spread through their seeds. It is mostly found growing on dry places, bareland, wasteland, roadsides and on the side of railway track.
**Genus: Solanum:** Various medicinally important plants are found in solanaceae family. Solanum is a large genus in this family. Mainly it consists of perennial as well as annual growing plants. It includes variety of plants like vines, shrubs, subshrubs herbs and small trees with attractive colored flowers and fruits. It includes various types of the plants which show toxic and medicinal value. It consists of more than 1500 species of the plant. Some of them have economic importance throughout their international distribution (Edmonds et al; 1997). Solanum is the most commercially and economically important genera of Solanaceae family which had been widely studied.

**Nightshade family (SOLANACEAE)**

![Genus Solanum diagram]

**MEDICINAL PROPERTIES:**
Since Solanum xanthocarpum is pricky herb found mostly in bare waste land, dry places and on road side (Anonymous. Indian herbal pharmacopoeia 1998). In Ayurveda it is important member of dasmula. Several reports are available on the medicinal uses and impotance of solanum xanthocarpum. It is especially used in Ayurveda for the treatment of asthma (Govindan s. et al;1999), diabetes (Kar DM et al;2006), cough, chest pain, stone in the bladder, rheumatism, catarrhal fever flatulence, constipation, toothache and bronchospasm. The solanum xanthocarpum shows different medicinal properties. The properties like antioxidant, antifilarial activity, hepatoprotective activity, antifertility activity, apoptosis inducing activity, mosquito larvicidal activity and anticancer activity.

Medicinal properties:

- Antioxidant activity
- Antifilarial activity
- Antifertility activity
- Hepatoprotective activity
- Mosquito larvicidal activity
- Anticancer activity
- Skin repellency activity
- Apoptosis inducing activity
Traditional uses of *Solanum xanthocaroum*:

From the ancient time this plant is known as pungent, bitter in taste and digestive. It is also use as astringent. Aerial parts of pant like stems, fruits and flowers are bitter and carminative in nature. The plant extract used in piles and rejuvenation treatment. It is useful in the treatment of asthma and cough. (C. P. Khare et al.;1995).

From the stamens of flowers, linctuses prepared which is help to cure cough of kids. People are using whole plant for the treatment of several disorder. This plant has a great a importance in medicine. Many times it is use in the treatment of gonorrhea. Folk people use green leaves paste on body to get relief from body pain. Raw and mature fruits are used as medicine in the treatment of throat infection, dental infection and some inflammatory troubles (Sinha S.C;1996). Seeds of the fruits are used by females for the treatment irregular menstruation and heart related problems. In burning sensation of feet, different aerial parts of *Solanum xanthocarpum* like flowers, fruits and stem are used to relief of vesicular eruption. In Rajasthan state, mukundara tribes utilized the root paste in the treatment of hernia. In flatulence and constipation treatments roots are administered.

Anti-inflammatory activity is observed in dried fruit extract of the plant. this activity is possesss in fruit extract due to the presence of sterol and carpesterol. (Bhattacharya TK et al;1980)). The seeds of the fruits are beneficial in dysmenorrheal and irregular menstruation. The the treatment of piles, fumigation of plant is very beneficial and decoction used in the treatment of gonorrhea (Sharma N et al;2010). For the treatment of headache and migraineins this herb is very beneficial. Its nasal admistration reduces the pains of migraineins and headache.
CHEMICAL CONSTITUENTS OF SOLANUM XANTHOCARPUM: The constituents of Solanum xanthocarpum are reported. It contains alkaloids like solanine-s, solanocarpine solasodine and solamargine. β solamargine. It is rich source of amino acids, carbohydrates and fatty acid. carpesteral, caffic acids, proteins, flavonoids, tannins, lipids, scopolin, esculin, esculetin, coumarins, carpesterol, solasonine, flavonal glycoside apigenin, sotosterol, lipids and fats are also present in solanum xanthocarpum. It is shown on in following table No.1.1 with application of aerial parts. (Khanna et al;1974)

Chemical constituents observed from solanum xanthocarpum plant:

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Chemical constituents</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coumarins</td>
<td>(Khanna et al;1974)</td>
</tr>
<tr>
<td>2</td>
<td>Alkaloids</td>
<td>Khanna et al;1974)</td>
</tr>
<tr>
<td>3</td>
<td>Carbohydrates</td>
<td>Khanna et al;1974)</td>
</tr>
<tr>
<td>4</td>
<td>Sterols</td>
<td>Khanna et al;1974)</td>
</tr>
<tr>
<td>5</td>
<td>Flavonoids</td>
<td>Khanna et al;1974)</td>
</tr>
<tr>
<td>6</td>
<td>Caffeic acid</td>
<td>Khanna et al;1974)</td>
</tr>
<tr>
<td>7</td>
<td>Fatty acid and amino acids.</td>
<td>Khanna et al;1974)</td>
</tr>
<tr>
<td>8</td>
<td>Tannins</td>
<td>Khanna et al;1974)</td>
</tr>
<tr>
<td>9</td>
<td>Proteins</td>
<td>Khanna et al;1974)</td>
</tr>
<tr>
<td>10</td>
<td>Lipids and fats</td>
<td>Khanna et al;1974)</td>
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</tbody>
</table>

Table No.1.1 Chemical constituents observed from solanum xanthocarpum plant:
<table>
<thead>
<tr>
<th>Part of Plant</th>
<th>Solvent</th>
<th>Carbohydrates</th>
<th>Phytosterol and sterols</th>
<th>Tannins</th>
<th>Amino acids and proteins</th>
<th>Sapons</th>
<th>Alkaloids</th>
<th>Flavonoids</th>
<th>Fixed oil and fats</th>
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<tr>
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<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
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<td>+</td>
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<tr>
<td></td>
<td>Alcohol</td>
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<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Acetone</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
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<td>-</td>
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<tr>
<td>Leaves</td>
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<tr>
<td></td>
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<td>+</td>
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<td>-</td>
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<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>
Table.No.1.2 Phytochemical constituents of Solanum xanthocarpum.

**Different parts of plant and its description:**
The roots of *Solanum xanthocarpum* are used as a medical ingredient use in Ayurveda for the treatment of various diseases. The root can relieve problems of scorpion and snake bites. A paste made from root and lemon juice can be applied on the affected area to get relief. Roots and seeds of the plant are used as an expectorant in asthma, as well as in treatment of cough and severe pain in chest. The Paste of the leaves is applied externally for healing the wounds and it is uses as a pain relieving agent. The mixture of leaves juice and black pepper used in rheumatism. Flowers are uses for decoration, for dying and fragrance. White flowered kantkari uses in the treatment of conception in womens. It is use as stimulation and edema treatment. Fruits are used as a cigarette for smoking. To remove infection of teeth its smoke hold up in mouth. Fruit juice is also beneficial in the treatment of piles and sore throat. Its paste is used for pimples treatment. The stem juice is useful on abortion and burning sensation of feet. (Sharma N .et al;2010 The stem juice is useful on abortion and burning sensation of feet. Seeds of the mature fruits are used by females for the treatment of irregular menstruation cycle and to get relief from pain from heart related diseases (Ramaswamy et al., 2005).

K Poongothai reported that phytochemical screening of field grown *Solanum xanthocarpum* and in vitro rasied *solanum xanthocarpum* leaves were analyzed on dry weight basis. (K.poongothai ;2011). The result of proximal composition showed a higher value in the contents of in vitro rasied Solanum xanthocarpum leaves than the field grown *solanum xanthocarpum* leaves. Mineral analysis also showed that the presence of high amount of phosphorus, nitrogen, potassium, magnesium, manganese, zinc, calcium and sulphur content in in vitro rasied Solanum xanthocarpum leaves.

**TISSUE CULTURE IN SOLANUM XANTHOCARPUM:**
For the production of medicinal plants, tissue culture method plays an important role. It was seen that production of medicinal plants is increased by tissue culture. A very limited work was done on micropropagation in different plants of solanaceae family like *Solanum trilobatum* (Arulmozhi et al; 1997). This technique is also applied on solanum surattense (pawar et al; 2002). From the solanaceae family, solanum *trilobatum* have reported for micropropagation and organogenesis.

**Glycoalkaloids from solanum xanthocarpum:** Solasonine is the main glycoalkaloid of Solanum xanthocarpum. It was verified with molecular formula C45H73NO16 by Briggs. (Briggs; 1939). The other researcher and Briggs et al reported that solasonine on acidic hydrolysis forms solasodine aglycone and solanosodine with straight chain trisaccharides. (K Scheriber; 1955). Finally Briggs again investigated the structure of carbohydrates moiety of solamargine and solasonine. He stated that both contains the structure of branched trisaccharides.

**Structural formula of alkaloids from solanum xanthocarpum:**

<table>
<thead>
<tr>
<th>Molecular Formula:</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_{27}H_{29}NO_2$</td>
</tr>
<tr>
<td>$C_{45}H_{73}NO_{15}$</td>
</tr>
</tbody>
</table>
Germination and Seed sterilization:
The process of germination is used as follows regularly for other seeds. In case of the seeds of *solanum xanthocarpum* were washed and covered with water for soaking in soap solution for half an hour in a solution of soap. The treatment was done for 30 minutes and clean with water. After washing with tap water, seeds again clean with water for 3 to 4 times and sterilized with air flow to get rid of foreign material including microbes/bacteria. The surface of seeds was sterilized for 5 minutes with sodium hypochlorite and three times rinsed with sterile distilled water. The sterilized seeds used for germination (Kilankaje A et al; 2013). Plant tissue culture micropropagation provides techniques which helpful in economic growth of species. The plant tissue culture can change or reduce the pathway of metabolic from the plant and produces new compounds which are previously not found in whole plants (Stafford; 1991).

Micropropogation of solanum xanthocarpum:
In Indian system of medicine, Solanum xanthocarpum is considered as one among the ten principles of medicinal roots. In the orientation of large numbers of shoots from callus (35 shoots/callus) was used with combination of 0.25 mg/l Kinetin and 0.75 mg/l BAP. It was reported that MS media supplemented with 0.5 mg/l BAP was great consideration for elongation in vitro shoots. During acclimatization, 95% of in vitro raised shoots stay alived.

Regularly flowered come out on hard tissue cultured Solanum xanthocarpum plants and produced fruits after one month of hardening. The study on micro propagation of Solanum xanthocarpum is very limited. (Sundar and Jawahar 2011, Saxena et al. 1982; Rahman et al. 2011).

In this plant micropropagation has been studied through in vitro direct shoot regeneration. Ramaswamy et al. (2005) was studied the somatic embryogenesis for shoot regeneration of solanum surettens (Ramaswamy et al. 2005).
Figure 1.5. Acclimatized invitroraised plantlets of (kantkari) *Solanum xanthocarpum* (Kilankaje Ashakiran et al; 2013)

*solanum xanthocarpum* (Kilankaje Ashakiran et al; 2013)
Growth and Production of Solanum xanthocarpum: (Brindha V; 2014)

Due to the medical value of Solanum xanthocarpum in various types of diseases, the production and growth of this plant has become very important. The growth of this plant was studied by using different media like control, vermicompost, cow dung, compost and chemical fertilizer. It was observed that in vermi compost media the best growth of the plant was reported.

Through the system of organic farming various types of organic food products are produced. Now a days there is great demand of organic products. Everyone demand for the organic product and hence the growth and production rate is also increases. Healthy soil is required for the foundation of organic farming. The aim of organic farming practices to increases quality of soil and give protection to the ecosystem in the farm without using any chemical fertilizers. For such a organic farming the use of vermiculture can be used. The organic farming change can determined the sustainable cultivation. It may need enormous tolerance for the farmers throughout the transition time and till the yield is return to unique stage. For the scientific society, it will be one more challenge. It is also as great as in first Green revolution which was started in 1950.

Agrochemicals increase the productivity of farms and keep away the increasing human being from starvation (Conway; 1989). A vast investment of the government is required for construction local potential of farmers in developing countries. For future and current capacity building such type of investment is necessary to feed world. would be an investment both in the current as well as in the future capacity building of the farmers to feed the world.
For sustainable food production the earthworms and its metabolic products may improve the soil fertility, quality and health. It can improve the yield of the crops and protects from the infection and diseases. It also improves chemical and physical properties of soil. Agrochemicals and fertilizer can be completely replaced with vermicompost. Such farming is being termed as sustainable agriculture. Addition of micro-organisms to the soil can provides foodstuff for the existing microorganisms in soil and therefore boost the biological activities. It also increases the self renewal capacity soil fertility (Shiralipour et al; 1992).

Solanum xanthocarpum growth was experienced in five different media. These mediums were selected like control, compost, chemical fertilizer, vermicompost, and cow dung. Earthworms species like P. excavates, E. fetida, and E. euginae were selected and nourish on cattle dung and kitchen waste materials. Chemical fertilizers like urea for 1.40 gm nitrogen, single 2.50 gm of super phosphate and 1.04 gm potash was used. With the help of the methods used by Jesikha and Lekeshmanaswamy, the medium for growth of plant was prepared. (Jesikha and Lekeshmanaswamy; 2012). For the period of 60 days the growth and mass production was recorded.

It was reported that annual use of sufficient amount of vermicompost also lead to significant boost in soil enzyme actions such as phosphor mono esterase, phosphor diesterase urease, and arylsulphatase. It has seen that the soil treated with vermicompost shows considerably more electrical conductivity and neutral pH (Tiwari et al; 1989). Higher aeration, capacity, porosity, and water holding capacity was observed in Vermicompost.

Vermicompost is a very nutritive organic fertilizer which is contains 2-3% of nitrogen 1.85-2.25%, potassium and 1.55-2.25% phosphorus. It also contains micronutrients and helpful soil microbes. These microbes like mycorrhizal fungi and nitrogen-fixing bacteria which scientifically shows miracle growth protectors and promoters (Kale and Bano; 1986). The result of experiment was signifying the better availability of essential micronutrients. In soil addition of useful microbes in vermicompost is important. Most outstanding observation was appreciably less occurrence of pests and infection effects in vermicompost applied crops.
Characteristics properties of solanum xanthocarpum:
1] Solanum xanthocarpum is bitter in taste.
2] It is febrifuse and use to reduce the fever.
3] Solanum xanthocarpum is expectorant and use to cure cough.
4] It is caminative and relives the abdominal pains.
5] It is anthelmintic and astringent.
6] It is digestive.

Application of solanum xanthocarpum in various disorders treatments:
1] It is applicable in gum and toothache disorder.
2] It is applicable in respiratory disorder:
3] It is used in snake bite treatment.
4] It is used in throat and stomach infections.
5] It is used as nasal drop.
6] It is used to cure the disorder like dropsy.
7] It is used to treat epilepsy and kidney stones.
8] It is used in the treatment of gonorrhea and anthritics.

Mineral analysis for solanum xanthocarpum:
Proximate composition of chemical constituents of solanum xanthocarpum was also analysed/estimated by researchers. Mineral content depends on water and soil quality. The growth analysis and composition of solanum xanthocarpum leaves were evaluated. Various content like chlorophyll and carotenoids extracted by Arnon method. (Arnon D. et al; 2011). Dubois estimated total sugar from solanum xanthocarpum. (Dubois M et al; 1956). Total Protein can be estimated by using Lowery method. (Lowry 1951.) Total lipid can carried out by the Folch method. (Folch et al; 1957). Estimation of amino acid was carried out by Moore and Stein method (Moore S. et al; 1948).
Minerals like magnesium, manganese, calcium, potassium, zinc, sulphur can estimated by using (AAS) atomic absorption spectrophotometer. This method of AAS is suggested by the Helrich K. (Helrich et al; 1990)

Application of some other plants:

Atropine is extracted from Atropa belladonna which possesses the property of Anticholonergic. Cinchona ledgeriana contains quinine and use as antimaterial. Lavender oil is present in Lavendula vera and use as perfume. Nicotiana, tabacum and Chrysanthemum contains nicotine and pyrethrin respectively which are used as insecticides. From the plant Papaver somniferous various constituents are extracted. Codeine is one of them extracted and possess the analgesic a property. Digitalis lanata contains Digoxin which use as Cardiatic. Jasminum plants use as perfumes because of jasmine oil. Flavours for food and different types of additives are obtained from the Capsaiscin Lycopersicon Crocin esculentum Thaumaten Sweetener Taumatococcus slamelli Pungency Capscicum annum Lycopene Red pigment

Phytochemical screening of plants:

In metabolic processes some chemical compounds are formed are called as Phytochemicals. The production of such chemicals in the plants for the protection of itself. Now in the current research field it has been proved that these phytochemicals
also protect human being from diseases and infections. These chemical compounds are also called as secondary metabolities. It includes terpenes, polysaccharides, terpenoids coumarins, glycosides, flavonoids, gums, tannin, phenols and alkaloids (Harborne; 1973 and Okwu; 2004). In 2008 Soetan reviewed the pharmacological and some other advantageous effects of anti nutritional factors in plants. The plants are used in traditional medicine because of the presence of secondary metabolites.

About 50,000 types of secondary metabolites produces by plants which includes 4000 types of flavonoids, 12000 types of alkaloids, 100 types of glucosinolates, 60 kinds of cyanogenic glycoside and 15000 types of terpenes. These are already identified and reported (Croteau et al; 2000). With the technique of definite biochemical pathways, phytochemicals can be produced in plant cell. Phytochemicals can be used in the wide range of medicine to poisons.

**Phytoremediation:**

It is an innovative use of crops and green plants for cleaning the environment. The meaning of the term is used for the detoxification, remedial of soil or contamination of water with heavy metals or excess of minerals. Toxic products, sewage, contaminated, water industrial wastes, agricultural waste, pesticides, heavy metals, insecticides, municipal waste and some other byproducts come out from our daily actions and activities from the different parts of the city. The disposal of this waste is not done properly and hence this wastage gets accumulated into soil and the balance of minerals and structure of soil. Phytoremediation is creative and pleasant method used to reduce the remedial cost, cleaning the concentration and restore habitat in position rather than entomb in place or moving it to another location. For the protection of rice crops, carbofuran pesticides are widely used to kill rice insect. But after spraying this pesticide about 99% of it remains in residual forms in environment. It was reported that the Solanum xanthocapum shows the ability of degradation of carbofuran residue in farm of rice crop and hence this plant was investigated for the phytoremedial function.

**1.2 WORK TAKEN IN HAND:**
In the present study, the problem is taken in hand regarding the formulation of alkaloids and colourants from Solanum xanthocarpum.

Natural products are extracted by Solvent, Soxhlet, and ultrasound waves methods. Different methods were tried for extraction and which gives the higher yield of the crude alkaloids. Purification of alkaloid was carried out on adsorption chromatography. UV spectrum, IR, NMR, TLC and physical constant carried out for the Structural elucidation of alkaloids

1. Collection of plant material from different location of India Optimization of techniques was done along with literature survey.

2. Isolation of alkaloids by solvent, soxhlet methods from Solanum xanthocarpum leaves.

3. New novel method for alkaloids extraction from leaves of Solanum xanthocarpum

4. To check the validity of novel method.

5. Comparative study of above methods

6. Purification of alkaloids by column chromatography

7. Structural determination by physical constant, UV, IR, TLC, NMR and MS and XRD

8. Extraction of dyes or colourants from leaves and fruits of Solanum xanthocarpum

9. Application of dye or colourants on fabrics of cotton, silk and papers.

1.3 PRESENT STUDY FOR PH.D:

Aim and Objective: In the present investigation,

- Literature survey

- Purification and evaluation of alkaloids from Solanum xanthocarpum is necessary for following study

- Phytochemical screening of roots, leaves, fruits and flower of Solanum xanthocarpum will be carried out.

- Isolation of dye from aerial parts. / Extraction of colorant.

- Statistical analysis of above study.

- Application of dye.
Methodology:

1. Isolation of alkaloids by modern method (Goswami & Tayade 2007), Purification of alkaloids on gel exclusive chromatography, affinity chromatography, GCMS and purity with HPLC, ICP, MS, IR, UV, TLC.


4. Colorant analysis by quantitative and qualitative method.

1.4 SCOPE:

Present investigation of research may focus on purification of alkaloids of Solanum xanthocarpum and estimation of colourants from the aerial parts like fruits and leaves of the plant. The various alkaloids as well as dyes from the plant may be formulated which may be designed will be beneficial to the society. Alkaloids are cyclic organic compound that contain nitrogen in a negative oxidation state and is of limited distribution among living organisms. Many herbs are used for improving the overall resistance of body against common infections. Solanum xanthocarpum has been used and reported in many formulations. Different types of alkaloids extracted from the fruits but extraction of alkaloids from leaves is not done. Yet only flowers of Solanum xanthocarpum were explored for colourant study due to their attractive colours. Present study focused on formulation of alkaloids and colourants. Present attempt may contribute for formulation of alkaloids and colorants from aerial parts of plant Solanum xanthocarpum.

Pigments and colorants are occurs in plant and animal are generally called as natural colors. Four main types of natural pigments are considered named as anthocyanins,
betalains, chlorophylls and carotenoids, (Giusti, S. et al; 2008). The use of natural colors derived from the animals and plants has increased significantly due to the awareness of consumers. Some factors like light fastness, metals, oxygen, pH and temperatures affecting on the natural colorants because natural colors have the low intensity to these factors. (Giusti, S. et al; 2008)

Some extra complexity occurs related to the use of natural colourants due to the presence of unwanted fragrance, difficulties in the process of purification in large quantities and not accurately matches with characteristics of current synthetic colorants. (Giusti, Schwartz et al. 2008 and Massa and Brouillard ;1987). On the other hand the synthetic colorants low in cost and having high stability but having minimum, high stability, minimum involvement for taste of the food, and distinct color intensities (Downham and Collins ;2000 ). The synthetic dyes cause the harmful effects on human and environment therefore most of the countries are interested in natural dyes to avoids the toxicity, allergic and harmful effects of synthetic dyes.

Definitely present evalution is innovation in dye chemistry. Extraction of dye and statistical analysis give definitely fruitful result. These eco friendly dyes will help to minimize use of synthetic dyes and reduces the harmful effect on health of human being and our environment. The extracted alkaloids from leaves of solanum xanthocarpum will be applicable in medicine formulation. As this herb is very beneficial from the ancient period, its detail investigation is also helpful to the society for curing various disorders.
1.5 ORGANIZATION:

The research work is carried out in the **B. N. BANDODKAR COLLEGE OF SCIENCE, THANE (W) 400601.(MS) INDIA** Reaccredited 'A' Grade by NAAC University of Mumbai awarded 'Best College Award' ‘O’ level. VPM’s B.N.Bandodkar College of Science, Chadani Bunder road, Thane (W) 400602, University of Mumbai was established in August 1935 at the historical lake city Thane. It is well known education capus known as Jnandweepa that is “Island of Knowledge”, under the great visionary of Ex. President Late Dr. V.N. Bedekar. The vision imparting quality education in science and to mould students, efficient workers, rational thinkers and social awareness qualified citizens of India with great mission for young generation for developing Thane city and to develop this young generation in to educated citizens of India. Department of chemistry was developed since 1985. The college having various educational facilities for students likes undergraduate, post graduate and Ph.D. The department conducts various projects for students like NGOs and Government projects. It receives many funding projects from (UGC) University of Mumbai. It is well equipped and with best infrastructure college. Every year approximately 40-50 papers published from the various laboratory of B.N. Bandodkar College. This college accepts new challenges like fast growing technology in the educational field for the overall development of students as well as college
Library

B.N.Bandodkar college library is well enriched with books, e-journals, journals and some other resources. The area of library is 1153 Sq.feet. Different types of books are like educational books, magazines of science and some other knowledgable books are also available in this library. It subscribes 25 magazines and 39 latest scientific Journals. Total 20,200 books are available in the library. It was recored that bout 75 to 80 books have been read by students and teachers per day. It is computerized long back and working on Catalogue of Online Public Access. Web OPAC Library database facility is available from anywhere in the world. It is the best library because every facility is available in the library of B.N.Bandodkar College. This is one of the best library because of all facilitites are available in it. Avaiability of books and reading facilities in library is very nice. For the research students the various types of journals are available. Online journals are also available for the students.

Databases:
OpenJ-Gate, PubMed, Gateway, SSRN (Social Science Research Network), DOAR and SSIG (Social Science Research) are available.

Infra structure: Total constructed area : 5920 sq.m Campus area : 13 acres
Library area : 359 sq.m
1.6

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RATIONAL HYPOTHESIS:

India is rich ancient traditional systems of medicine which provides a strong support for the utilization of a various types of medicinal plant for health care of human being and some other living organism. In India, herbal drugs are available but very few have been studied thoroughly. In Ayurvedic medicine *Solanum xanthocarpum* is a very important medicinal herb that possesses a great medicinal potential including hypoglycemic, hepatoprotective, and antimicrobial, fungicidal, antibacterial, antiasthmatic and insect repellent properties. In India, from the ancient time different parts of medicinal plants are used for making ornamental and traditional medicine system for folk. Being very much significantly used this wasteland weed having diversified potential, widely available; *solanum xanthocarpum* is selected for formulation of alkaloids and mainly focused on dyes /colourants. There is a great interest in phytochemical screening and extraction of dyes approach along with statistical analysis of various alkaloids which are required for healthy human life and environment. The alkaloids extracted from solanum xanthocarpum.

1.7 Detail history and criticality of the project:

Natural sources provided the biological active compounds and has become the richest source in medicine. Researchers are taking the efforts on such compounds and provide the information about their physical and chemical properties. In Indian medicinal system
many plants are well-known for their medicinal properties. Natural products show the
great potential in health of human being in the form of medicine and healthcare
products. In pharmaceutical companies, research and development are paying attention
in research of drugs development. The advances and application of biological
technology greatly support evidence-based phytotherapeutics. Such research show the
way to modify or change the pattern application and development of medicinal plants.
Instrumentation and developed methods are very much facilitate by these study and
appealing to reminder yield of minor alkaloids or more investigation.

The alkaloids were isolated by researcher during the first part of the last century is not
so sufficient more than thousand times over for the analysis of complete structure.
In the second half of the 20th century alkaloids are characteristic powerfully in the
research of for anticancer activity by using the drugs obtained from the plants.
Biological activity of of natural products has been tested and found below ten percent.
Synthetic drugs are very costly but with combination with natural drug compounds
reduce the cost of synthetic medicine. Natural products contain a small molecule which
shows properties of drugs because of their biological activity. These small molecules in
the drugs easily get absorbed and metabolized in human body without any harmful
effects. Medicinal plants play an important role in health care product of human being.
Most of the tribal people are used the medicinal plants for the treatment of various
diseases and disorders. The scientific study is also provides the medicinal data about
the various medicinal plants availability in India. The plant kingdom provides the main
source of natural products. For the formulation of medicine from the plants by different
methods of extraction has been developed. New drug development research is taking
place in research and development. The researchers are conscious about the
importance of medicinal plants.

Literature survey suggested and gave depth knowledge of solanum *xanthocarpum*
since it widely used as traditional curative plant for different types of illness. It is one
of the dasamula and has been used from the ancient time as a drug in Ayurveda.
From various collection data of the researcher to use its bio constituents for the living
organism like animals and humans life. Worldwide *solanum xanthocarpum* is
considered as a waste land weed and are used as ornamental and traditional medicine system for antimicrobial, anthelmintic, antioxidants insecticidal and anticancer activity etc. It has been proved that use of *Solanum xanthocarpum* possess remarkable therapeutic potential efficiency of medicine. It is cure the various types of diseases (Roshy J et al;2012). *Solanum xanthocarpum* is common medicinal plant widely recognized in Ayurvedic and folklore system of Indian medicine. The plants used for medicinal remedy like in fever, cough, dyspnoea, asthma, constipation, diuretic (Singh D.et al 1996). It has been examined for different pharmacological properties. (Gupta M.et al; 1938 and Govindan s.et al ;1999). In phytochemical investigation of solanaceae family, it was reported that it contains alkaloids (Maxwell A.et al.1996), flavonoids (Kang S.et al; 1998), steroidal glycoside (Ripperger H.et al; 1995) and steroidal saponins (Zamilpa A.et al 2002). Fruit juice of kantkari is useful in the treatment of curing sore throat and later recognized as tissues alkaloids. Khanna et al; in 1976 reported that the hydrolyzed base occurs in the tissue of *Solanum xanthocarpum*. Verbiest et in 1974 compared the alkaloid constituents of *Solanum xanthocarpum* collected in Nepal and France. It was noted that the fruit from the French contains higher percentage of solasodine as compare to fruit from Nepal. Solasodine glycoside than those of the Nepalese origin. It was observed that the plants collected from these two sources contain trace amount of tomatidenol.(Verbiest J.et al 1974).(Verbiest J.et al 1977). Tupkari in 1972 isolated conmanns, scopoletin, eaculetin from the dry leaves, root and fruits of it.(Tupkari et al;1977). They confirmed that their glycosides ecololin and esculin nature of the plant. In 1978, Dubey and Gupta reported the isolation of quercetin-3-O-β-D-glucopyranosyl-O-β-D-manno pyranoside apigenin and sitosterol from flowers of *Solanum xanthocarpum*. (Dubey et al ;1978). The history concludes that biosynthetic studies gave direction to increase the production of secondary constituents of the plant (Hemble M.et al;1971)( Hemble M.et al;1968). Shelly Rana et al (2016) reported that leaves extract of solanum xanthocarpum with methanol and acetone shows antibacterial activity .Authors proved that leaves extract possess the property of inhibiting staphylococcus Aureus growth which causes harmful infection in wounds of human being .Due to the occurrence of phenolics , alkaloids and flavonoids in solanum xanthocarpum leaves extract ,shows antibacterial property(Shelly
R.et al ;2016). Shivani G. analyzed the microscopic and photochemical properties of root of solanum xanthocarpum which was helpful for quality determination of crude drugs .It was proved that some constituents like steroids ,saponins flavoinoid,alkaloids proteins and carbohydrates are present in root extract. .

The photochemical screening showed the contents of the roots. This method was also determined the presence of impurities in root extract. Tannins and triterpenoids are also found in root of solanum xanthocarpum. Presence of ash is determine the purity of drugs. (shivani G.et al;2014). The extract of kantkari shows bronchodilator effects and reduces wheezing in childrens after half an hour. This research gives new path for herbal drug remedy and evaluated the effect of katkari extract by nebulisation in wheezing treatment. (Patil Amol et al ;2014) Solanum surattense extract is very beneficial in pharmaceutical use for making various types of medicine. Pathogenic microorganism are dangerous for human being. Solanum surattense is useful and powerful against microorganism action. The region of inhibition can be changed on the basis of the extract concentration. The effect of the concentration was proved by John B. (John. Bitto 2001). Marcos S. in 2004 proved that method like agar well diffusion used against the microorganism Marcos Salvador et al ;2004). Sheeba studied the purification and evaluation and toxicity of the constituents of solanum surranttence and specified that at higher concentration extract was bacteriostatic. (sheeba E.;2010). It was reported that berries of solanum xanthocarpum linn and solanum nigram shows anti allergic activity. The contents like solasodine glycoalkaloid is isolated from methanol extract of both plant. These species are well-known for the treatment of antiallergic disorders.

Solanum xanthocarpum alkaloids solanine, solamargine (Kuo et al ;2000), sapogenins (Erdogrul OT et al ;2002) and solasodine (Dixit VP et al ;1982 and Dixit VP et al ;1986) are also responsible for medicinal effect. Isolation of caffeic acid and oleanolic acid from the roots has been carried out using different chromatographic methods (Bhat, B. et al; 2011).

Since ancient time till today most of the tribal people relay on plants based medicines for acute as well as chronic diseases. Solanum Xanthocarpum is one of the most
therapeutically used medicine for the treatment of headache, toothache, abscess, throat disorder, cough, piles, swelling, tonsillitis, snake bite and other respiratory diseases. Solanum xanthocarpum has wide significance in traditional medicine for the treatment of infections related to throat and some other inflammatory disorders (Singh et al; 2003).

Kiritikar in 1994 reported that fruits of the plant are used because of the medicinal properties like antipyretic, anti asthmatic and anthelmintic activities (Kiritikar et al; 1994). Its paste externally applicable for treatment of swelling of body and pimples (Jain and Puri; 1984). The extract of whole kantkari plant exhibits molluscicidal and insecticidal properties(Singh and Bansal; 2003). For indigestion purpose the fruits of the kantkari are eaten as an anthelmintic. It was reported that for the chest pain, cough and asthma the extract of the root use as an expectorant. In natural treatments of rheumatism, gonorrhea sore throat, juice of fruits is very beneficial.

Natural dyes or pigments, perfume, alkaloids and some other constituents are extracted from nature grown plants. Increasing huge demand of such plants they are getting extinct and damage. Number of plants are decreasing by utilization of them in various field. For the production of phytochemicals technology of plant, cell culture has been developed. Now a days the pollution is increasing due to fast growing industrialization and urbanization. There are many reasons for the increasing pollution such as surfactants, solvents, auxiliary chemicals unabsorbed and untreated dyes, chemicals effluents from the dyeing process. To reduce the environmental pollution the standard by bureau of Indian standand should be followed for the pollution treatment. The research and development department as well as environmentalists and researcher are taking effort for not pollute the environment rather than to treat the waste.

From the ancient civilization to this modern age, the art of dyeing is wellknown. Since the bronze age it is practicing in various fields. As the synthetic dyes give beautiful and strong colours but they are carcinogenic and causes inhalation of benthic photosynthesis (Adeel et al; 2009).

Now a day natural dyes having a demand in textile industry as well as in food, cosmetics, leather, and pharmaceuticals. Natural dyes are superior to synthetic dyes
since they are ecofriendly in nature and increase the options of an income through sustainable harvesting. In the present study, *solanum xanthocarpum* may be used especially for development of technology and its renewable applications also beneficial to our society

**Limitation:**

1] In extraction process different solvents used for alkaloids formation may or may not be behave differently.
2] Different extraction methods used for alkaloids develops errors and may vary the results. The methods used for extraction purpose of alkaloids are soxhletextractor and solvent, modern method.

The yield of the product also varies with different solvents used and method engaged for the extraction of crude material
3] Solvent available, which can able to extract alkaloids completely from the solution .Therefore selection of solvent will be crucial.
4] Extraction of dyes using different methods may or may not be shows various shades of colours.
5] Colours shades of dyes should be varies with or without mordants
6] Colours of dyes may be varies with oxidation or with effect of light and temperature.
7] Natural products tend to decompose on heating which needed care to be taken.
8] Most of the natural product do not dissolve completely in solvent therefore proper selection of solvent is significant.

**Utility:**

1. According to the study of many analytical reports, Solanum plants are important source of of phytochemical compounds with substantial curative application against human pathogens. Hence they could be assessed as an alternate way to fight against
bacterial diseases

2. Increasing the polarity of various solvents, concentration of extracted compounds and their antibacterial as well as antifungal activity increases. Hence the rural community mostly uses this plant as a folk medicine from ancient time.

3. Solanum xanthocarpum plant is rich in many phytoconstituents like Alkaloids, Proteins, Saponins, Flavonoids, Carbohydrates, Tannins, Terpenoids Phenolic compounds, and Steroids. Due to the beneficial effects of this plant, it has been used from the ancient time.

4. Studies of Solanum xanthocarpum indicate that, it shows antifertility, antipyretic, anti-allergy, anti-histaminic, hypoglycemic, anti-inflammatory, antiasthmatic, anti-fungal, anthelmintic, anti-tussive, anti-oxidant, and anti-bacterial activity.

5. Presence of various phytoconstituents are responsible different like therapeutic activities like Carminative, expectorants, Febrifuge and Astringent.

6. The alkaloids will be useful in medicine formulation for curing various disorders.

6. Weedland plant can be utilized to extract the natural dyes which are ecofriendly and beneficial in nature. Such dyes will be applicable in various fields for dyeing.

7. Natural dyes have no side effects and can be considered ecofriendly; safe, efficient and economical. Therefore, natural dyes act as centre of research.