# HERBAL TECHNOLOGY

## HISTORY OF PHARMACOGNOSY

In the early period, primitive man went in search of food and ate at random, plants or their parts like tubers, fruits, leaves, etc. As no harmful effects were observed he considered them as edible materials and used them as food. If he observed other effects by their eating they were considered inedible, and according to the actions he used them in treating symptoms or diseases. If it caused diarrhea it was used as purgative, if vomiting it was used as mimetic and if it was found poisonous and death was caused, he used it as arrow poison. The knowledge was empirical and was obtained by trial and error. He used drugs as such or as their infusions and decoctions. The results were passed on from one generation to the other, and new knowledge was added in the same way.

### Ancient China

Chinese pharmacy, according to legend, stems from Shen Nung (about 2700 B.C.), emperor who sought out and investigated the medicinal value of several hundred herbs. He reputed to have tested many of them on himself, and to have written the first *Pen T-Sao*, or *Native Herbal*, recording 365 drugs. These were subdivided as follows: 120 emperor herbs of high, food grade quality which are non-toxic and can be taken in large quantities to maintain health over a long period of time, 120 minister herbs, some mildly toxic and some not, having stronger therapeutic action to heal diseases and finally 125 servant herbs that having specific action to treat disease and eliminate stagnation. Most of those in the last group, being toxic, are not intended to be used daily over a prolonged period of weeks and months. Shen Nung conceivably examined many herbs, barks and roots brought in from the fields, swamps and woods that are still recognized in pharmacy (podophyllum, rhubarb, ginseng, stramonium, cinnamon bark and ephedra).

Inscriptions on oracle bones from the Shang Dynasty (1766–1122 B.C.), discovered in Honan Province, have pro-vided a record of illness, medicines and medical treatment. Furthermore, a number of medical treatises on silk banners and bamboo slips were excavated from the tomb number three at Ma-Huang-Tui in Changsha, Hunan Province. These were copied from books some time between the Chin and Han periods (300 B.C.–A.D. 3) and constitute the earliest medical treatises existing in China.

The most important clinical manual of traditional Chinese medicine is the *Shang Hang Lun* (*Treatise on the Treatment of Acute Diseases Caused by Cold*) written by Chang Chung-Ching (142–220). The fame and reputation of the Shang Han Lun as well as its companion book, *Chin Kuei YaoLueh* (*Prescriptions from the Golden Chamber*), is the historical origin of the most important classical herbal formulas that have become the basis of Chinese and Japanese-Chinese herbalism (called 'Kampo').

With the interest in alchemy came the development of pharmaceutical science and the creation of a number of books including Tao Hong Jing's (456–536) compilation of the *Pen T'sao Jing Ji Zhu* (*Commentaries on the Herbal Classic*) based on the Shen Nong Pen T'sao Jing, in 492. In that book 730 herbs were described and classified in six categories: (1) stone (minerals), (2) grasses and trees, (3) insects and animals, (4) fruits and vegetables, (5) grains and (6) named but unused. During the Sui dynasty (589–618) the study of herbal medicine blossomed with the creation of specialized books on plants and herbal medicine. Some of these set forth the method for the gathering of herbs in the wild as well as their cultivation. Over 20 herbals were chronicled in the *Sui Shu JingJi Zhi* (*Bibliography of the History of Sui*). These include the books *Zhong Zhi Yue Fa* (*How to Cultivate Herbs*) and the *Ru Lin Cat Yue Fa* (*How to Collect Herbs in the Forest*).

From the Sung Dynasty (960–1276) the establishment of pharmaceutical system has been a standard practice throughout the country. Before the ingredients of Chinese medicine can be used to produce pharmaceuticals, they must undergo a preparation process, e.g. baking, simmer-ing or roasting. The preparation differs according to the needs for the treatment of the disease. Preparation methods, production methods and technology have constantly been improved over time.

In 1552, during the later Ming Dynasty, Li Shi Zhen (1518–1593) began work on the monumental *Pen T'sao Kan Mu* (*Herbal with Commentary*). After 27 years and three revisions, the *Pen T'sao Kan Mu* was completed in 1578. The book lists 1892 drugs, 376 described for the first time with 1160 drawings. It also lists more than 11,000 prescriptions.

**Ancient Egypt**

The most complete medical documents existing are the *Ebers Papyrus* (1550 B.C.), a collection of 800 prescriptions, mentioning 700 drugs and the*Edwin Smith Papyrus* (1600 B.C.), which contains surgical instructions and formulas for cosmetics. The *Kahun Medical Papyrus* is the oldest—it comes from 1900 B.C. and deals with the health of women, including birthing instructions.

However, it is believed that the Smith Papyrus was copied by a scribe from an older document that may have dated back as far as 3000 B.C.

Commonly used herbs included: senna, honey, thyme, juniper, cumin, (all for digestion); pomegranate root, henbane (for worms) as well as flax, oakgall, pine-tar, manna, bayberry, ammi, alkanet, aloe, caraway, cedar, coriander, cyperus, elderberry, fennel, garlic, wild lettuce, nasturtium, onion, peppermint, papyrus, poppy-plant, saffron, watermelon, wheat and zizyphus-lotus. Myrrh, turpentine and acacia gum were also used.

**Ancient India**

In India knowledge of medicinal plants is very old, and medicinal properties of plants are described in *Rigveda* and in *Atharvaveda* (3500–1500 B.C.) from which *Ayurveda* has developed. The basic medicinal texts in this world region— The Ayurvedic writings—can be divided in three main ones *(Charaka Samhita, Susruta Samhita, Astanga Hrdayam Samhita)* and three minor ones (*Sarngadhara Samhita, Bhava Prakasa Samhita, Madhava Nidanam Samhita).* Ayurveda is the term for the traditional medicine of ancient India. Ayur means life and veda means the study of which is the origin of the term. The oldest writing—*Charaka Samhita*—is believed to date back six to seven centuries before Christ. It is assumed to be the most important ancient authoritative writing on Ayurveda. The *Susruta Samhita* is thought to have arisen about the same time period as the *Charaka Samhita,* but slightly after it *Astanga Hrdayam* and the *Astanga Sangraha* have been dated about the same time and are thought to date after the*Charaka* and *Susruta Samhitas*. Most of mentioned medicines origin from plants and animals, e.g. ricinus, pepper, lilly, valerian, etc.

**Ancient Greece and Rome**

Greek scientists contributed much to the knowledge of natural history. Hippocrates (460–370 B.C.) is referred to as father of medicine and is remembered for his famous oath which is even now administered to doctors. Aristotle (384–322 B.C.), a student of Plato was a philosopher and is known for his writing on animal kingdom which is consid-ered authoritative even in twentieth century. Theophrastus (370–287 B.C.), a student of Aristotle, wrote about plant kingdom. Dioscorides, a physician who lived in the first century A.D., described medicinal plants, some of which like belladonna, ergot, opium, colchicum are used even today. Pliny wrote 37 volumes of natural history and Galen (131–A.D. 200) devised methods of preparations of plant and animal drugs, known as 'galenicals' in his honour.

Theophrastus

Galen

Pliny

Pharmacy separated from medicine and materia medica, the science of material medicines, describing collection, preparation and compounding, emerged.

Even upto the beginning of twentieth century, pharma-cognosy was more of a descriptive subject akin mainly to botanical science, and it consisted of identification of drugs both in entire and powdered conditions and concerned with their history, commerce, collection, preparation and storage.

## INDIAN SYSTEMS OF MEDICINE

**Introduction**

It is a well-known fact that Traditional Systems of medicines always played important role in meeting the global health care needs. They are continuing to do so at present and shall play major role in future also. The system of medicines which are considered to be Indian in origin or the systems of medicine, which have come to India from outside and got assimilated in to Indian culture are known as Indian Systems of Medicine (India has the unique distinction of having six recognized systems of medicine in this category. They are-Ayurveda, Siddha,

Unani and Yoga, Naturopathy and Homoeopathy. Though Homoeopathy came to India in 18th Century, it completely assimilated in to the Indian culture and got enriched like any other traditional system hence it is considered as part of Indian Systems of Medicine. Apart from these systems- there are large number of healers in the folklore stream who have not been organized under any category. In the present review, attempt would be made to provide brief profile of three systems to familiarize the readers about them so as to facilitate acquisition of further information.

Ayurveda

Most of the traditional systems of India including Ayurveda have their roots in folk medicine. However what distinguishes Ayurveda from other systems is that it has a well-defined conceptual framework that is consistent throughout the ages. In conceptual base, it was perhaps highly evolved and far ahead of its time. It was among the first medical systems to advocate an integrated approach towards matters of health and disease. Another important distinguishing feature of Ayurveda is that unlike other medical systems, which developed their conceptual framework based on the results obtained with the use of drugs and therapy, it first provided philosophical framework that determined the therapeutic practice with good effects. Its philosophical base is partly derived from *'Samkhya'* and *'Nyaya vaisheshika'* streams of Indian philosophy. This enabled it to evolve into rational system of medicine quite early in its evolution and to get detached from religious influence. It laid great emphasis on the value of evidence of senses and human reasoning (Historical background

Ayurveda literally means the Science of life. It is presumed that the fundamental and applied principles of Ayurveda got organized and enunciated around 1500 BC. *Atharvaveda*, the last of the four great bodies of knowledge- known as Vedas, which forms the backbone of Indian civilization, contains 114 *hymns* related to formulations for the treatment of different diseases. From the knowledge gathered and nurtured over centuries two major schools and eight specializations got evolved. One was the school of physicians called as *'Dhanvantri Sampradaya'* (Sampradaya means tradition) and the second school of surgeons referred in literature as *'Atreya Sampradaya'*. These schools had their respective representative compilations- Charaka Samhita for the school of Medicine and Sushruta Samhita for the school of Surgery. The former contains several chapters dealing with different aspects of

medicine and related subjects. Around six hundred drugs of plant, animal and mineral origin have been mentioned in this treatise.

Sushruta Samhita primarily deals with different aspects of fundamental principles and theory of surgery. More than 100 kinds of surgical instruments including scalpels, scissors, forceps, specula etc. are described along with their use in this document. Dissection and operative procedures are explained making use of vegetables and dead animals. It contains description of about 650 drugs and discusses different aspects related to other surgery related topics such as anatomy, embryology, toxicology and therapeutics). Vagabhata's 'Astanga-Hridaya' is considered as another major treatise of Ayurveda. The above three documents are popularly known as *'Brihat trayees'* (the big or major three). In addition to these three scholarly and authoritative treatises a vast body of literature exist in the form of compilations covering a period of more than 1500 years.

Till the medieval period it was perhaps the only system available in the Indian sub-continent at that time to cater to the healthcare requirement of the people. It enjoyed the unquestioned patronage and support of the people and their rulers. This can be considered as the golden period of Ayurveda because most of the work related to basic concepts, enunciation of different principles, evolvement of different formulations occurred during this period. The patronage for the Ayurvedic system of medicine considerably decreased during the medieval period, which was marked by unsettled political conditions in the country and series of invasion by foreigners. The neglect became worse during British rule during which importance was given to Allopathy through official patronage. In the early part of $20^{th}$ century interest in Ayurveda rekindled as part of national freedom movement. People's representatives even in British India and princely states started asking for suitable measures to develop Ayurveda on scientific lines.

After India gained Independence from the British rule in 1947, the movement for revival of Traditional Systems of Medicine gained momentum. The systems got official recognition and became part of the National Health care network to provide health care to the country's citizen. Government of India initiated a series of measures to improve the position of Ayurveda as one of the major health care systems vital for catering to the primary health care needs of the country. A number of hospitals and colleges for Ayurveda were established. The other major initiatives were establishment of a research Institute to take care of the R & D

needs (Central Institute of Research in Indigenous System of Medicine (CIRISM)- in 1955); a Post Graduate Training Centre of Ayurveda in 1956- to impart Post graduate education; establishment of a University- named Gujarat Ayurved University at Jamnagar in the Gujarat State in 1967; creation of Central Council of Indian Medicine (CCIM) in 1972 for regulating Education and Registration in Ayurveda, Siddha and Unani systems of medicine. A research council named Central Council for Research in Indian Medicine, Homoeopathy and Yoga (CCRIMH) was established in 1971. Subsequently, this council was bifurcated to create three separate councils -Central Council for Research in Ayurveda & Siddha (CCRAS), Central Council for Research in Unani Medicine (CCRUM), Central Council for Research in Homoeopathy (CCRH) and Central Council for Research in Naturopathy and Yoga (CCRNY). National Institute of Ayurveda (NIA) was established at Jaipur in Rajasthan state. Recently another University has been established known as Rajasthan Ayurved University-Jodhpur (Rajasthan state). A draft national policy for the development of Indian System of Medicine has been prepared which is available on the web site of Department of Ayurveda.

The concept of health in Ayurveda

In India, Ayurveda is considered not just as an ethnomedicine but also as a complete medical system that takes in to consideration physical, psychological, philosophical, ethical and spiritual well being of mankind. It lays great importance on living in harmony with the Universe and harmony of nature and science. This universal and holistic approach makes it a unique and distinct medical system. This system emphasizes the importance of maintenance of proper life style for keeping positive health. This concept was in practice since two millennium and the practitioners of modern medicine have now taken into consideration importance of this aspect. Not surprisingly the WHO's concept of health propounded in the modern era is in close approximation with the concept of health defined in Ayurveda.

The philosophical background

The basic foundation is the fundamental doctrine according to which whatever present in the Universe (macrocosm) should be present in the body (the microcosm). It has been conceptualized that the universe is composed of five basic elements named *Prithvi* (Earth), *Jala* (Water), *Teja* (Fire), *Vayu* (Air) and *Akash* (Space/Ether). The human body is derived from them in which these basic elements join together to form what are known as ‘Tridoshas’ (humors) named as *Vata, Pitta and Kapha*. These humors govern

and control the basic psycho-biological functions in the body. In addition to these three humors, there exist seven basic tissues (*saptha dhatus*)- *Rasa, Rakta, Mamsa, Meda, Asthi, Majja* and *Shukra*- and three waste products of the body *(mala)* such as faeces, urine and sweat. Healthy condition of the body represents the state of optimum equilibrium among the three doshas. Whenever this equilibrium is disturbed due to any reason- disease condition results. The growth and development of the body components depend on nutrition provided in the form of food. The food is conceptualized to be composed of the basic five elements mentioned above. Hence it is considered to be the basic source material to replenish or nourish the different components of the body after the action of bio-fire (*Agni*). The tissues of the body are considered as the structural entities and the humours are considered as physiological entities, derived from different combinations and permutations of the five basic elements.

**The concept of pathogenesis**

People are categorized in to different categories based on their psychosomatic constitution. Constitution specific daily (*Dinacharya*) and seasonal routines (*Ritucharya*) are prescribed to maintain positive health. Body may become afflicted with disease if these routines are not adhered to. This will lead to the loss of equilibrium among the three humors. The loss of equilibrium of the three humors can also occur as a consequence of dietary indiscrimination, undesirable habits, seasonal abnormalities, improper exercise or erratic application of sense organs and incompatible actions of the body and mind.

Disease condition may ensue due to other reasons also. For example any external factor like microorganism, changes in the climatic conditions may cause the accumulation of dosha leading to disturbance in the doshic equilibrium and vitiation of doshas. It is conceptualized that normally doshas are circulated through macro and micro-channels known as *srotas*. The srotas are the important medium through which the body tissues get their nutrition and also the metabolic end products are transported out of the tissue. If any blockade occurs (*srotorodha*) due to accumulation of doshas, the bi-directional flow of nutrients and end products (*malas*) gets affected. The doshas accumulated in the region react with the dushyas (reactants- in this case tissues) resulting in a condition known as *dosha dushya sammurchana*- this affects body metabolism. *Ama*, which is a semi-processed intermediary product of metabolism, gets accumulated. At this stage the prodromal symptoms of the disease gets

manifested. Thus disturbances in the bio-channels are considered to be the main reason for the expression of diseased state of an organ or system.

**Diagnosis**

The diagnosis is always done by considering the patient as a whole object to be examined. The physician takes a careful note of the patient's internal physiological characteristics and mental disposition. He also studies other factors like- the affected bodily tissues, humors, the site at which the disease is located, patient's resistance and vitality, his daily routine, dietary habits, the gravity of clinical conditions, condition of digestion and details of personal, social, economic and environmental situation of the patient. The general examination is known as ten-fold examination- through which a physician examines the following parameters in the patient- 1. Psychosomatic constitution, 2. Disease susceptibility, 3. Quality of tissues, 4. Body build, 5. Anthropometry, 6. Adaptability, 7. Mental health, 8. Digestive power, 9. Exercise endurance and 10. Age. In addition to this, examination of pulse, urine, stool, tongue, voice and speech, skin, eyes and overall appearance is also carried out.

**Treatment aspects**

The treatment lies in restoring the balance of disturbed humors (doshas) through regulating diet, correcting life-routine and behavior, administration of drugs and resorting to preventive non-drug therapies known as 'Panchkarma' (Five process) and *'Rasayana'* (rejuvenation) therapy. Before initiating treatment many factors like the status of tissue and end products, environment, vitality, time, digestion and metabolic power, body constitution, age, psyche, body compatibility, type of food consumed are taken in to consideration.

**Types of Treatment**

The treatments are of different types- a- *Shodhana* therapy (purification treatment), b-*Shamana* therapy (palliative treatment), *Pathya Vyavastha* (prescription of appropriate diet and activity), *Nidan Parivarjan* (avoidance of causes and situations leading to disease or disease aggravation), *Satvajaya* (psychotherapy) and *Rasayan* (adaptogens- including immunomodulators, anti-stress and rejuvenation drugs) therapy. *Dipan* (digestion)

and *Pachan* (assimilation) enhancing drugs are considered good for pacifying the vitiated doshas (humors). This therapy is supposed to dissolve the vitiated and accumulated doshas by improving the *agni* (digestive power) and restoring the deranged metabolic process. In severe conditions the above therapy has to be supplemented with purificatory processes like Panchakarma. In this therapy initially the accumulated vitiated dosha is liquefied by resorting to external and internal oleation of the patient; followed by sudation (*swedhana*) and elimination of vitiated dosha through emesis (*Vamana*) or purgation (*Virechana*), *Basti* (*enema*- evacuating type) and Nasya (nasal insufflation).

*Shodhana* therapy provides purificatory effect through which therapeutic benefits can be derived. This type of treatment is considered useful in neurological and musculo-skeletal disorders, certain vascular or neuro-vascular states, respiratory diseases, and metabolic and degenerative disorders. *Shamana* therapy involves restoring normalcy in the vitiated doshas (humors). This is achieved without causing imbalance in other doshas. In this use of appetizers, digestives, exercise and exposure to sun and fresh air are employed. In the *Pathya Vyavastha* type of treatment certain indications and contraindications are suggested with respect to diet, activity, habits and emotional status. In *Nidan Parivarjan* type of treatment the emphasis is on avoiding known causes of the disease by the patient. In *Satvavajaya* type of treatment the emphasis is on restraining the mind from the desires for unwholesome objects and Rasayana therapy deals with the promotion of strength and vitality.

**Siddha system of medicine**

Siddha system of medicine is practiced in some parts of South India especially in the state of Tamilnadu. It has close affinity to Ayurveda yet it maintains a distinctive identity of its own. This system has come to be closely identified with Tamil civilization. The term '*Siddha*' has come from '*Siddhi*'- which means achievement. *Siddhars* were the men who achieved supreme knowledge in the filed of medicine, yoga or *tapa* (meditation) (Narayanaswamy, 1975).

It is a well-known fact that before the advent of the Aryans in India a well-developed civilization flourished in South India especially on the banks of rivers Cauvery, Vaigai, Tamiraparani etc. The system of medicine in vogue in this civilization seems to be the precursor of the present day Siddha system of medicine. During the passage of time it interacted with the other streams of medicines complementing and enriching them and in turn

getting enriched. The materia medica of Siddha system of medicine depends to large extent on drugs of metal and mineral origin in contrast to Ayurveda of earlier period, which was mainly dependent upon drugs of vegetable origin.

According to the tradition eighteen Siddhars were supposed to have contributed to the development of Siddha medicine, yoga and philosophy. However, literature generated by them is not available in entirety. In accordance with the well-known self-effacing nature of ancient Indian *Acharyas* (preceptors) authorship of many literary work of great merit remains to be determined. There was also a tradition of ascribing the authorship of one's work to his teacher, patron even to a great scholar of the time. This has made it extremely difficult to clearly identify the real author of many classics.

**Philosophical foundation**

According to the Siddha concepts matter and energy are the two dominant entities, which have great influence in shaping the nature of the Universe. They are called *Siva* and *Sakthi* in Siddha system. Matter cannot exist without energy and vice-versa. Thus both are inseparable. The universe is made up of five proto-elements. The concept of five proto-elements and three doshas in this system of medicine is quite similar to Ayurvedic concept pertaining to them. However there are certain differences in the interpretation (Narayanaswamy, 1975). The concepts behind diagnostic measures also show great similarities differing in certain aspects only. Diagnosis in Siddha system is carried out by the well -known *'ashtasthana pareeksha'* (examination of eight sites) that encompasses examination of *nadi* (pulse), *kan* (eyes), *swara* (voice), *sparisam* (touch), *varna* (colour), *na* (tongue), *mal a* (faeces) and *neer* (urine). These examination procedures are provided in greater detail in classical Siddha literature in comparison to classical literature of Ayurveda (Narayanaswamy, 1975).

**Principles of treatment**

Similar to Ayurveda, Siddha system also follows ashtanga concept with regards to treatment procedures. However the main emphasis is on the three branches - *Bala vahatam* (pediatrics), *Nanjunool* (toxicology) and *Nayana vidhi* (ophthalmology). The other branches have not developed to the extent seen in Ayurveda. The surgical procedures, which have been explained in great detail in Ayurvedic classics, do not find mention in Siddha

classics. The therapeutics in both the systems can be broadly categorized into *samana* and *sodhana* therapies. The latter consists of well-known procedures categorized under panchakarma therapy. This therapy is not that well developed in Siddha system, only the vamana therapy has received attention of the Siddha physicians (Narayanaswamy, 1975).

**Materia medica**

The concept pertaining to drug composition, the concept of *rasapanchaka* (concept explaining drug properties) is almost similar in both the systems of medicine. One of the major characteristic features of Siddha materia medica is utilization of mineral and metal-based preparations to greater extent in comparison to the drugs of vegetable origin.

The mineral and metal-based drugs in Siddha System are categorized under the following categories: 1. *Uppu (Lavanam)*- drugs that are dissolved in water and get decrepitated when put into the fire giving rise to vapor. 2. *Pashanam* : drugs that are water insoluble but give off vapors when put in to fire 3. *Uparasam*: Similar to pashanam chemically but have different actions. 4. *Ratnas and uparatnas*, which include drugs based on precious and semi-precious stones 5. *Loham* - metals and metal alloys that do not dissolve in water but melt when put in to fire and solidify on cooling. 6. *Rasam*: drugs that are soft, sublime when put in to fire changing into small crystals or amorphous powders. *7. Gandhakam:* sulphur is insoluble in water and burns off when put into fire. From the above basic drugs compound preparations are derived. From the animal kingdom thirty-five products have been included in the materia medica. It is much similar to preparations used in Ayurveda. Numbers of plant-based preparations are also used in Siddha system of medicine they are quite similar in profile to those mentioned in Ayurveda.

**Unani system of medicine Historical background**

Unani medicine has its origin in Greece. It is believed to have been established by the great physician and philosopher- Hippocrates (460–377 BC). Galen (130–201 AD) contributed for its further development. *Aristotle* (384–322 BC) laid down foundation of Anatomy & physiology. *Dioscorides* - the renowned physician of the 1st Century AD has made significant contribution to the development of pharmacology, especially of drugs of plant origin. The next phase of development took place in Egypt and Persia (the present day Iran). The

Egyptians had well evolved pharmacy; they were adept in the preparation of different dosage forms like oils, powder, ointment and alcohol etc. (http://www.indianmedicine.nac.in).

The Arabian scholars and physicians under the patronage of Islamic rulers of many Arabian countries have played great role in the development of this system. Many disciplines like chemistry, pharmaceutical procedures like distillation, sublimation, calcinations and fermentation were developed and refined by them. There are many well-known names- only some names have been mentioned in this article. Jabir bin Hayyan (717–813 AD) a Royal physician of his time has worked on the chemical aspects; Ibne Raban Tabari (810–895 AD) is the author of the book- *Firdous ul Hikmat* and introduced concept of official formulary. *Abu Bakar Zarakariya Razi* (865–925 AD) has authored a book known as "*Alhawi fit tibb*". He has worked in the field of immunology. Of course the name of Bu Ali Sina (Avicenna 980–1037 AD) is always referred in all matters related to Unani. He was a renowned global level scholar and philosopher. He had great role in the development of Unani medicine in the present form. His book *Alqanoon or (The canon of medicine)* was an internationally acclaimed book on medicine, which was taught in European countries till the 17$^{th}$ century. Many physician of Arab descent in Spain have also contributed to the development of the system. Some of the important names are-*Abul Qasim Zohravi (Abulcasus* 946 – 1036 AD) he is the author of the famous book on surgery "*Al Tasreef*"-(http://www.indianmedicine.nac.in).

The Arabs were instrumental in introducing Unani medicine in India around 1350 AD. The first known Hakim (Physician) was Zia Mohd Masood Rasheed Zangi. Some of the renowned physicians who were instrumental in development of the system are- Akbar Mohd Akbar Arzani (around 1721 AD)- the author of the books- *Qarabadin Qadri* and *Tibbe Akbar*; Hakim M. Shareef Khan (1725–1807)- a renowned physician well-known for his book *Ilaj ul Amraz*. Hakim Ajmal Khan (1864–1927) a great name among the 20$^{th}$ Century Unani physicians in India. He was a multifaceted personality besides being a physician he was a scientist, politician and a freedom fighter. He was instrumental in the establishment of Unani and Ayurvedic College at Karol Bagh, Delhi. He was a keen researcher and has supervised many studies on *Rauwolfia serpentina*- the source plant for many well-known alkaloids like reserpine, Ajamaloon etc. Another great contributor is Hakim kabeeruddin (1894–1976), he has translated 88 Unani books of Arabic and Persian languages into Urdu. The first institution

of Unani medicine was established in 1872 as Oriental College at Lahore in the undivided India. Thereafter many institutions came into existence.

After Independence Unani received boost in the form of Government support through various agencies involved in the development of ISM. At present there are more than 30 colleges offering degree course in Unani medicine and the approximate number of physician turn out is around 20,000. There are around 177 hospitals. A National Institute of Unani Medicine has been established at Bangalore in Karnataka state in 1983 in collaboration with the Govt. of Karnataka- for catering to both academic and R & D requirements. Central Council for Research in Unani Medicine (CCRUM), is the premier agency involved in R & D activities (http://www.indianmedicine.nac.in).

**Basic principles**

According to the basic principles of Unani the body is made up of four basic elements i.e. Earth, Air, Water, Fire which have different Temperaments i.e. Cold, Hot, Wet, Dry. They give raise, through mixing and interaction, to new entities. The body is made up of simple and complex organs. They obtain their nourishment from four humors namely- blood, phlegm, black bile and yellow bile. These humors also have their specific temperament. In the healthy state of the body there is equilibrium among the humors and the body functions in normal manner as per its own temperament and environment. Disease occurs whenever the balance of humors is disturbed.

In this system also prime importance is given for the preservation of health. It is conceptualized that six essentials are required for maintenance of healthy state. They are i. Air, ii. Food and drink, iii. Bodily movements and response, iv. Psychic movement and repose, V. Sleep and wakefulness and vi. Evacuation and retention. Specific requirement for each of these six essentials have been discussed- (Syed Khaleefathullah, 2002).

The human body is considered to be made up of seven components, which have direct bearing on the health status of a person. They are 1. Elements *(Arkan)* 2. Temperament *(Mijaz)*. 3. Humors *(Aklat)* 4. Organs *(Aaza)* 5. Faculties *(Quwa)* 6. Spirits *(Arwah)*. These components are taken in to consideration by the physician for diagnosis and also for deciding the line of treatment (Syed Khaleefathullah, 2002).

**Diagnosis**

Examination of the pulse occupies a very important place in the disease diagnosis in Unani. In addition examination of the urine and stool is also undertaken. The pulse is examined to record different features like- size, strength, speed, consistency, fullness, rate, temperature, constancy, regularity and rhythm. Different attributes of urine are examined like odor, quantity, mature urine and urine at different age groups. Stool is examined for color, consistency, froth and time required for passage etc.

**Treatment**

Disease conditions are treated by employing four types of therapies- a- Regimental therapy, b-Dietotherapy, c-Pharmacotherapy and d- Surgery. Regimental therapy mainly consists of drug less therapy like exercise, massage, turkish bath, douches etc. Dietotherapy is based on recommendation of patient specific dietary regimen. Pharmacotherapy involves administration of drugs to correct the cause of the disease. The drugs employed are mainly derived from plants some are obtained from animals and some are of mineral origin. Both single and compound preparations are used for the treatment.

**Locally available medicinal Plants with Chemical Constituents and medicinal uses**

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| *Alternanthera sessilis* (L.) DC., Cat. Hort. Monspel. 77. 1813; Hook. f. in Hook. f., Fl. Brit. India 4: 713. 1885; Prain, Bengal Pl. 2: 875. 1903; Bennet, Fl. Howrah Dist. 140. 1979. Gomphrena sessilis L., Sp., Pl. 225. 1753. (AMARANTHACEAE) |

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| Local name : | "Sincheshak". |

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| Description : Annual or perennial, prostrate or decumbent-ascending much branched herb, often rooting at the lower nodes. Stems 4-angular, green or often purple-tinged, young portion with two opposite longitudinal lines of white hairs. Leaves up to 6.5 x 2 cm, varying from linear, linear-lanceolate, oblong, obovate or broadly elliptic, cuneate to attenuate at base, subacute or rounded at apex; petiole 1-5 mm long. Flowers ±1.5 mm across, borne in sessile or sometime shortly peduncled, globose heads. 1-4 together in axils, becoming cylindrical with age; bracts ± 0.8 mm long; bracteoles 1-1.2 mm long. Tepals 1.8-2 mm long, ovate-elliptic, subacuminate. Stamens 3 alternating with staminodes. Fruit 1.3-2 x 1.5-2.2 mm, obreniform, strongly compressed, dark brown. Seeds discoid, shining, brown. |

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| Fl. & Fr. : | Almost throughout the year. |

Chromosome Number : 34 Grant, W.F. 1964; Pal, M. 1964; 34, 96 Sharma, A.K. & Banik, M. 1965; 36 Mitra, K. & Datta, N. 1967; 60 Mittra, R. 1971.

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| Ecology : | Very common along the margin of water bodies, drainage canal, road side waste places highly variable according to habitat. |
| Distribution : | Very common throughout the district. |
| Part used : | Whole plant. |
| Properties : | The *plant* is sweet, astringent, slighty bitter, acrid, cooling, digestive, constipating, depurative, cholagogue, galactagogue and febrifuge. |

Uses : *Plant* is useful in vitiated condition of cough, burning sensation, diarrhoea, leprosy, skin disease dyspepsia, haemorrhoids, agalactia, splenomegaly and fever.

Chemical Constituents : The *plant* contain α and β-spinasterols; lupeol isolated from roots. Isolation of 24-methylenecycloartanol, cycloeucalenol, campesterol, sitosterol, stigmasterol, 5α-stigmast-7-enol and their respective palmitates, nonacosane, 16-hentriacontane, β-sitosterol, stigmasterol and handianol isolated. A saponin having oleanolic acid as aglycone and glucose and rhamnose as sugars isolated from *leaves*.

Chemical structures of some compounds:

*Amaranthus spinosus* L., Sp. Pl. 991. 1753; Hook. f. in Hook. f., Fl. Brit. India 4: 718. 1885; Prain, Bengal Pl. 2: 869. 1903; Bennet, Fl. Howrah Dist. 136. 1979. (AMARANTHACEAE)

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|---|---|
| Local name : | "Kanta Notey". |

Description : Erect, much-branched glabrous herbs, up to 60 cm high; armed with stright up to 1.5 cm long axillary spines. Stems terete, green or sometime suffused with purple. Leaves long-petioled, 1.5-8.5 x 0.6-4 cm, ovate-lanceolate to rhomboid-elliptic, apex acute or obtuse, base cuneate; Flowers in dense axillary clusters; lower clusters, entirely female; higher ones collected into spikes or penicles representing female in lower part and wholly male in upper part. Male flowers: Tepals 5, 2.5-3 mm long, ovate or lanceolate; stamens 5. Female flowers: Tepals 5, 1.5-2 mm long, oblong, apiculate. Styles 2-3, divaricate. Utricle ovoid-oblong, circumscissile. Seeds 0.8-0.9 in diam, biconvex, shining black.

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| Fl. & Fr. : | Almost throughout the year. |

Chromosome Number : 32 Subramanyum, K. & Kamble, N.P.; 34 Takagi, F. 1933; Murray, M.J. 1940a.

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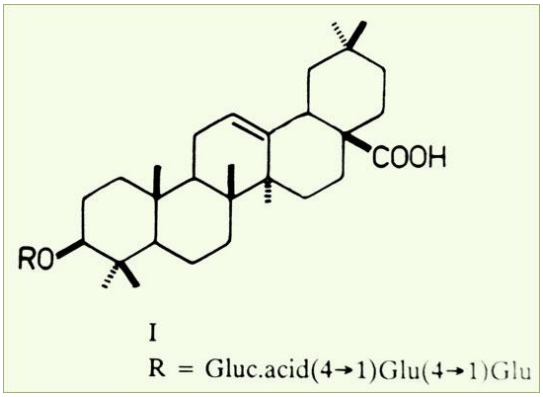
| Ecology : | Common in waste places, roadsides and fields. |
| Distribution : | Common throughout the district. |
| Part used : | Whole plant. |
| Properties : | The *plant* is sweet, cooling, alexiteric, laxative, diuratic, stomachic, antipyretic, febrifuge, sudorific, galactagogue, haematinic, appetiser & tonic. *Roots* are thermogenic, haemostatic. |

Uses : The *plant* is useful in hyperdipsia, burning sensation, hallucination, lepsory, eczema, bronchitis, leucorrhoea, menorrhagia, haemorrhoids, abscesses, boils, burns, strangury, nausea, flatulence, colic, anorexia, fever, intermittent fevers, agalactia, anaemia. *Roots* are useful in menorrhagia, haemoptysis, haematemesis and leucorrhoea.

Chemical Constituents : *Whole plant* contais higher alkanes and their methyl derivatives, higher aliphatic alcohols, acids and esters, amino acids, β-sitosterol, stigmasterol, campesterol, cholesterol, α-spinasterol, glycosides of α-spinasterol, oleanoic acid, quercetin, rutin, α-spinasterol octacosanoate. A new saponin-β-D-glucopyranosyl (1-4)-β-D-glucopyranosyl (1-4)-β-D-glucurono-pyramosyl(1-3)-oleanolic acid-(I) isolated from *roots*.

Chemical structures of some compounds:




I

R = Gluc.acid(4→1)Glu(4→1)Glu

Top

*Calotropis gigantea* (L.) R. Br. in Ait. f., Hort. Kew. 2: 78. 1811; Hook. f. in Hook. f., Fl. Brit. India 4: 17. 1883; Prain, Bengal Pl. 2: 688. 1903; Bennet, Fl. Howrah Dist. 286. 1979. *Asclepias gigantea* L., Sp. Pl. 214. 1753. (ASCLEPIADACEAE)

| Local name : | "Akanda". |
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Description : Erect large shrubs to small tree, to 3 m high, young parts downy-tomentose. Leaves sessile or subsessile, 7-16 x 4.5-8 cm, obovate-oblong or panduriform, cordate and semi-amplexicaul at base, abruptly acute at apex, pale green, glabrous above, cottony beneath. Cymes subumbellate; peduncles 5-10 cm long; pedicels 2-3 cm long. Bracts and bracteoles ± 1 cm long, lanceolate. Flowers 2.5-4.5 cm across, calyx-lobes 4-6 mm long, ovate, acute, puberulous outside. Corolla 1.5-1.8 cm long, purplish; segments 1-1.3 cm long, spreading, deltoid-ovate, subacute, revolute and twisted in age, thick-fleshy. Corona-lobes 1-1.2 cm long, shorter than the staminal column, pubescent, apex rounded with 2 obtuse auricles below it; top of column 5-angled. Follicles in pairs, boat-shaped, 6-10 x 3-4 cm, recurved, inflated, glabrous, green. Seeds numerous, 5-6 mm long, broadly ovate, flattened, brown, minutely tomentose, with 2.5-3 cm long silky coma.

| Fl. & Fr. : | Feb.-Aug. |
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| Chromosome Number : 22 Sreedevi, P. & Namboodiri, A.N. 1977; Mukherjee, P. 1980. | |
| Ecology : | Commonly found along roadside, railway track in open waste-lands near village surroundings etc. |
| Distribution : | Very common, throughout the district. |
| Part used : | Root, root-bark, leaves, latex, flowers. |
| Properties : | The whole plant is a good tonic, expectorant, depurative, anthelmintic, antiseptic, emetic, antiphlogistic. Leaves are antiphlogistic, acrid. Latex is antiseptic, vesicant, prophylaxis, and purgative. Root bark is febrifuge, anthelmintic, depurative, expectorant, laxative, substitute for ipecacuanha, antidysentric, antispasmodic, diaphoretic. |

Uses : *Root-bark*is useful in cutaneous diseases, intestinal worms, cough, ascites, anasarca, dysentery, constipation, piles, syphilis, elephantiasis, hydrocele; root smoke inhaled in case of migraine. *Roasted leaves* applied to painful joints on swellings; powder boiled in oil useful in eczema, skin eruptions, toothache, ulcers, wounds; tincture in intermittent fevers. *Latex* in low doses employed in asthma, bronchitis, allergy, prophylactic against malaria, produces abortion when a stick smeared with the latex is applied locally to induce uterine contractions.

*Flowers*are useful in asthma, catarrah, anorexia, inflammations, tumours. In large doses it is purgative and emetic.

Chemical Constituents : *Root* contains cardiac glycoside (calotropin, uscharidin), 1-methoxy-4-ethylnaphthalene; 6-(2-methyl-2, 3-dihydroxypentyl)-11, 11-dimethylcyclohexanyl-14, 19, 25 (tricyclo)-3,7, 11-trihydroxymethylenetridecane and 8, 15-dihydrobenzofuranyl-18-hepta-7, 15-dione-16-oic acid; calactin, calotroposides C,D,E,F,G (five oxypregnane-oligoglycosides, two oxypregnane-oligoglycosides, calotroposides A & B, designated as 12-o-benzoyllinedon-3-o-β-D-Cymaropyranosyl (1→4)-β-D-oleandropyranosyl (1→4)-β-D-cy-maropyranoside and 12-o-benzoyldeacetyl-metaplexigenin 3-o-β-D-cymaropyranosyl (1→4)-β-D-oleandropyranosyl, (1→4)-β-D-cymaropyranosyl, (1→4)-β-D-cymaro-pyranoside, uzarigenin etc.

*Root-bark* contains isovalerates of a kundrol, mudarol, giganticine (noprotein amino acid),

β-amyrin, β-amyrinacetate, tetracyclic resinols, sterols, acetic, isovaleric acids, isogiganteol, taraxasterol and its ψ-isomer, triterpenes identified as lup-13(18), 19(29)-dien-9α-yl acetate, lupeol acetate, urs-18β-H-12, 20(30)-dien-3β-yl-acetate and 17β-hydroxy-28-normethyl urs-18α-H-12, 20(30)-dien-3β-yl-acetate etc.

*Flowers* contain flavonol glycosides, hyperoside, rutin, amyrin, stigmasterol, anthocyanin, α and β-calotropeols etc.

*Leaves* contain holarrhetine, cyanidin-3-rhamnoglucoside, tarasasterol isovalerate, taraxasteryl acetate, β-sitosterol, amino acids.

*Latex* contains α and β-calotropeol, β-amyrin, gigantin, (toxic principle), proteases: calotropins DI & DII; Calotropins FI & FII, ester of acetic and isovaleric acids, glutathione, 3´-methylbutanoates of α-amyrin and ψ-taraxasterol, uscharin etc.

Chemical structures of some compounds:

*Gymnema sylvestre* (Retz.) R. Br. ex Schult., Syst. Veg. ed. 15, 6: 57. 1820; Hook f. in Hook. f., Fl. Brit. India 4: 29. 1883; Haines, Bot. Bihar & Orissa Pt. 4: 556. 1922. *Periploca sylvestre* Retz. Obs. Bot. 2: 15. 1781. (ASCLEPIADACEAE)

Description : Much-branched, slender, pubescent climbers. Leaves simple, opposite, 3.5-5x2.5-3 cm, thinly coriaceous, ovate-oblong or elliptic-oblong, rounded, truncate or subcordate at base, acute or shortly acuminate at apex, entire, pubescent; petiole 7-10 mm, pubescent. Cymes much shorter than leaves. Flowers minute, 3-3.5 mm across, pale-yellow; pedicel slender, 3-4 mm, long; bracts minute. Calyx up to 1 mm, 5-partite; segments broadly ovate. Corolla 2 mm long; lobes 5, spreading, recurved, corona 5. Stigma subglobose, exserted beyond the anthers. Follicles 6-7.5 cm long, slender, glabrous. Seeds ovoid-oblong, flat, margined, pale-brown.

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| Fl. : | Aug.-Sept. |
| Fr. : | Jan.-Mar. |

Chromosome Number : 22 Sreedevi, P. & Namboodiri A.N. 1977; Sanjappa, M. & Sathyananda, N. 1979.

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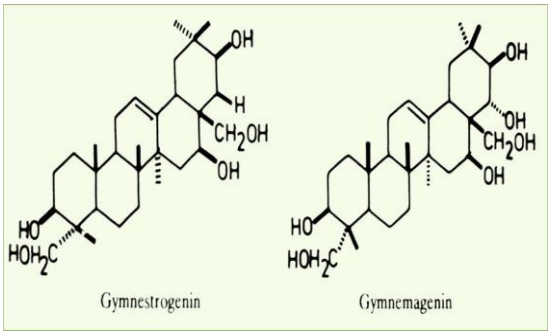
| Ecology : | Climbing on bushes and hedges. |
| Distribution : | Rare, so far found only in one spot (Noupala, Deulti). |
| Part used : | Whole plant, Leaves, Roots. |
| Properties : | *Plant* bitter, astringent, acrid, thermogenic, anti-inflammatory, sialagogue, anodyne, digestive, liver tonic, emetic, diuretic, stomachic, stimulant, anthelmintic, alexipharmic, uterine tonic, antipyretic, expectorant, laxative, antiperiodic. *Leaves* hypoglycaemic, when chewed paralyse temporarily the sense of taste for sweet and bitter. *Root* is astringent, emetic, expectorant, refrigerant, stomachic, tonic. |

Uses : *Plant* is useful in inflammations, colds, diabetes, worms, liver disorders, headache, hepatosplenomegaly, dyspepsia, constipation, jaundice, haemorrhoids, strangury, renal and vesical calculi, helminthiasis, cardiopathy, cough, asthma, bronchitis, intermittent fever, amenorrhoea, conjunctivitis, leucoderma. *Leaves* mixed with castor oil applied externally to swollen glands and to enlarged spleen; powder diuretic and stimulant.

Chemical Constituents *Plant* contains gymnamine (alkaloid); hentriacontane, non-acosane, pentatriacontane, tritriacon; conduritol A (cyclic alcohol); inositol, d-quercitol; α- & β-chlorophylls; butyric, formic and tartaric acids; β-amyrin, lupeol; stigmasterol; gymnamosaponins (I-V); D-glucosides of 3β, 16β, 23, 28-tetrahydroxyolean-12-ene, dammarane type saponins-gimnemasides (I-VII), gymnemagenin (3β, 16β, 21β, 22α, 23, 28-hexahydroxy-olean-12-ene), gymnestrogenin (3β, 16β, 21β, 23, 28-pentahydroxy-olean-12-ene), 3´-0-β-D-arabino 2-hexenopyranosylgymnemic and gymnemic acids, viz., 3-0-β-D-glucouronopyranosyl-gymnemagenin, its 21-o-acetyl-and tigloy-21-o-(2-methyl butyryl)-and 21, 22-0-ditigloyl derivatives, 3-0[β-D-glucopyranosyl

(1→3)-β-D-glucopyranosyl]-21-0-tigloyl-gymnemagenin and 3-0-β-D-glucuronopyranosylgymnestrogenin; gypenoside, gynosaponin TN-2, alanine, γ-aminobutyric acid,isoleucine, valine; adenine; choline, betaine etc.

Chemical structures of some compounds:




*Pergularia daemia* (Forsk.) Chiov., Result. Sc. Miss. Stefani-Paoli Somal. Ital. 1: 115. 1916; Bennet, Fl. Howrah Dist. 284. 1979. *Asclepias daemia* Forsk., Fl. Aegypt.-Arab. 51. 1775. *Daemia extensa* (Jacq.) R. Br. in Ait. f., Hort. Kew. ed. 2, 2: 76. 1811; Hook. f. in Hook. f., Fl. Brit. India 4: 20. 1883; Prain, Bengal Pl. 2: 692. 1903. (ASCLEPIADACEAE)

| Local name : | "Chagulbati". |
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Description : Twining herb; stems hispidly hairy. Leaves 5-12 x 3-10 cm, broadly ovate to suborbiculr with rounded incurved basal lobes, acute to subacuminate at apex, glabrous above, slightly pubescent beneath; petiole 4-9 cm long. Flowers in corymbose racemose cymes, drooping; peduncle 5-12 cm long, interpetiolar, stout, pubescent; pedicels 1.5-4 cm long, pubescent, slender, bracts minute, linear. Calyx 3-3.5 mm long, pubescent; lobes small, ovate-lanceolate, acute. Corolla 1-1.2 cm long; greenish-yellow or dull white; tube short infundibular; lobes twice as long as the tube, ovate-oblong, acute, spreading with reflexed villous margin; staminal corona in 2 series, outer a five-lobed, denticulate annuals at base of staminal column, the inner of 5 fleshy segments attached to column above its base. Follicles 4-5.5 cm long, lanceolate, narrowed into a long beak, softly-echinate, puberulous. Seed 5-6 mm long, broadly ovate, pubescent with, ciliate margin.

| Fl. & Fr. : | Oct.-Jan. |
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| Chromosome Number : 22 Navaneetham, N. 1980;<br>24 Mitra, K. & Datta, N. 1967. | |
| Ecology : | Commonly found in shrubbries hedges, fences near and with in villages. |
| Distribution : | Common throughout the district. |
| Part used : | Whole plant, leaves, root-bark, fruits. |
| Properties : | *Plant*is astringent, acrid, thermogenic, emetic, expectorant, emmenagogue, anthelmintic, antipyretic, laxative.<br>*Leaves*are bitter, thermogenic, anthelmintic, expectorant, emmenagogue and depurative.<br>*Fruits*are acrid, thermogenic, expectorant, digestive. |

Uses : : *Plant* is useful in urethrorrhoea, stangury, metropathy, inflammations, cough, asthma, amenorrhoea, dysmenorrhoea, intermittent fever, leucoderma; extract given in uterine and menstrual disorders and to facilitate parturition.

*Leaves*are useful in cough, helminthesis, asthma, haemorrhoids dyspepsia; juice given in catarrhal affections, infantile diarrhoea; combined with lime applied to rheumatic swellings; poultice prepared from fresh leaves applied to carbuncles, piles.

*Root-bark*mixed with cow's milk used as pargative.

*Fruits*are useful in cough, asthma, bronchitis, dyspepsia.

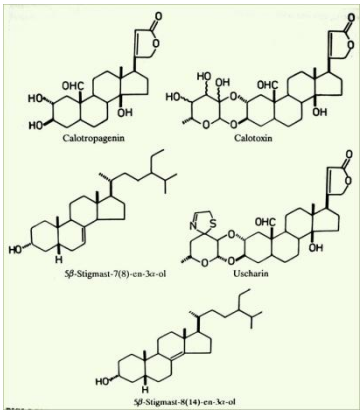
Chemical Constituents : *Plant* contains coroglaucigenin, uzarigenin, hentriacontane, β-amyrin, betaine, 5β-stigmast-7(8)-en-3α-ol, 5β-stigmast-8(14)-en-3α-ol; sugar residues of the hydrolysates of cardiac glycosides are D-cymarose, D-glucose, L-oleandrose, D-sermentose.

*Leaves*contain 3β-hydroxyfriedelan-7-one, lupeol and its acetate, oleanolic acid, putranjivadione, β-sitosterol.

*Roots*contain lupeol, α-amyrin and their acetate, β-sitosterol and its glucoside, calactin, calotropin.

*Seeds*contain coroglaucigenin, uzarigenin, calactin, calotropin, calotropigenin, corotoxigenin, dihydrocalotropigenin, protouscharin, uscharidin, uscharin etc.

Chemical structures of some compounds




*Sarcostemma secamone* (L.) Bennet in Indian For. 95: 692. 1969 & Fl. Howrah Dist. 285. 1979. *Periploca secamone* L., Mant. 2: 216. 1771. *Sarcostemma esculentum* (L.f.) R. Holm in Ann. Miss. Bot. Gard. 37: 482. 1950; Backer & Brink, Fl. Java. 2: 259. 1965. *Oxystelma esculentum* (L.f.) R. Br. ex Schult. in Syst. Veg. 4: 89. 1820. *O. secamone* (L.) Karst., Deut. Fl. 1031. 1880-1883. (ASCLEPIADACEAE)

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|---|---|
| Local name : | "Dudhlata". |

Description : Perennial much-branched slender twining herb with milky latex. Leaves 7-13 x 0.3-0.8 cm, deciduous, linear or linear-lanceolate, acuminate at apex, acute or rounded, pale green, glabrous; petiole 4-8 mm long, slender. Flowers large, drooping, in pedunculate lateral subumbellate or racemose few flowered cymes, longer or shorter than the leaves. Calyx glabrous, divided nearly to base; segment 5, 3.5-4.5 mm long, oblong-lanceolate. Corolla saucer-shaped, 2.5-3 cm in diam, rosy with purple-violet veins; segments 0.8-1 cm long, apex acute, margin densely villous. Corona staminal; lobes 5 mm long, lanceolate, acuminate with incurved entire, subulate tips. Anthers with inflexed deltoid tips. Follicles 4-6 cm long, ovoid-lanceolate, tapering towards the tip. Seeds many, 2.5-3 mm long, broadly-ovate, flat, black; coma 15-19 mm long.

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| Fl. : | Aug.-Oct. |
| Fr. : | Nov.-Dec. |

Chromosome Number : 22 Navaneetham, N. 1980.

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| Ecology : | Infrequently occurs in marshy and semimarshy areas. Often in |

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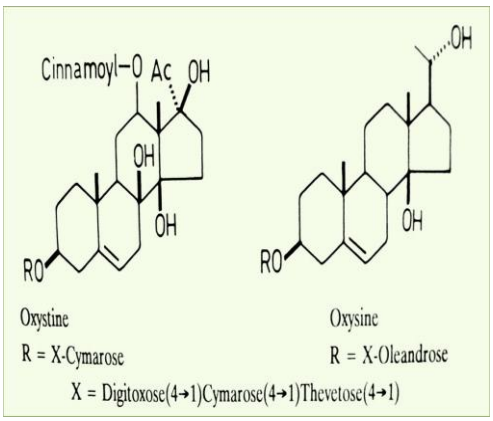
| | association with *Typha*. |
| Distribution : | Rare, in few part of the district. |
| Part used : | Whole plant, root, latex. |

Uses : : *Whole plant* antiseptic, depurative and galactagogue; decoction (used as gargle) beneficial in stomatitis and in sore throat, latex hastens healing.

*Root*efficacious in Jaundice.

Chemical Constituents : *Roots* contain a preghane ester oligoglycoside, calogenin-3-o-β-D-oleandropyranosyl (1→4)-0-β-D-thevetopyranosyl (1→4)-o-β-D-cymaropyranosyl (1→4)-o-β-D-o-digitoxopyranoside (oxysine), a triglycoside-sarcogenin-3-o-β-D-thevetopyranosyl-(1→4)-o-β-D-cymaropyranosyl-(1→4)-o-β-D-oleandropyrano-side (esculentin), cardenolide tetraglyco-side, viz., 3-epi-uzarigenin-3-o-β-D-cymaropyranosyl (1→4)-o-β-D-theveto-pyranosyl-(1→4)-o-β-D-cymaropyrano-syl(1→4)-o-β-d-digitoxopyranoside (oxyline) and 12-o-cinnamoyl-desacyl-metaplexi-genin-3-o-β-D-cyamaropyranosyl-(1→4)-o-β-D-thevetopyra-nosyl (1→4)-o-β-D-pyranosyl (1→4)-o-β-D-cymaro-pyranosyl (1→4)-o-β-D-digitoxopyrano-side (oxystine).

Chemical structures of some compounds:




Top

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| *Tylophora indica* (Burm.f.) Merrill in Philip., J. Sci. 19: 373. 1921; Bennet, Fl. Howrah Dist. 286. 1979. *Cynanchum indicum* Burm. f., Fl. Ind. 70. 1768. *Tylophora asthmatica* Wight & Arn. in Wight, Contri. 51. 1834; Hook. f. in Hook. f., Fl. Brit. India 4: 44. 1883; Prain, Bengal Pl. 2: 698. 1903. (ASCLEPIADACEAE) |

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| Local name : | "Antamul". |

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| Description : Perennial twiner; stem not much branched; roots somewhat fleshy. Leaves 5-10 x 2-6 cm, subfleshy, ovate or ovate oblong, acute or acuminate, often apiculate at apex, subcordate or rounded at base, entire, glabrous; petiole 1-2 cm long. Flowers in umbellate cymes. Peduncles shorter than the leaves, each bearing at its apex 2-3 nearly sessile umbels; pedicels slender; bracts linear. Calyx divided almost to the base; segments 3-4 mm long, linear-lanceolate, acute. Corolla yellowish-green with brown in side at base, 7.5-8.5 mm in diam.; lobes oblong, obtuse, 3 mm long. Corona large, gibbous below, abruptly narrowed at the apex to a free point, free tip nearly equal to the style apex. Follicles 7-10 cm long, tapering to a fine point at the apex, striate, glabrous. Seeds 7-8.5 mm long, broadly ovate; coma 2-2.5 cm long. |

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| Fl. : | Feb.-May. |
| Fr. : | July-Sept. |

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| Chromosome Number : 22 Sarkar, A.K. et al., 1973;<br>Sarkar, A.K., Datta, N. & Chatterjee, U. 1980. |

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| Ecology : | Commonly found in hedges & thickets. |
| Distribution : | Common throughout the district. |
| Part used : | Whole plants, leaves, root. |
| Properties : | The *root* and *leaves* are acrid, bitter, abortifacient, thermogenic, emetic, purgative, expectorant, diaphoretic, stomachic. |

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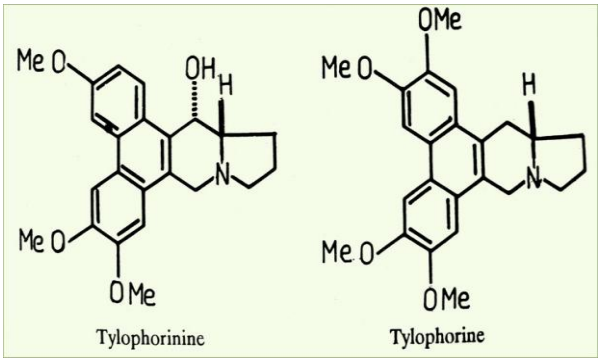
| Uses : *Whole plant* is a substitute for ipecac. *Leaves* are used as diaphoretic, emetic, expectorant; in powder form useful in diarrhoea, dysentery; decoction of leaves as well as root |

beneficial in asthma, bronchitis, diarrhoea and dysentery. *Root* highly effective as a alterative and anti-rheumatic, expectorant in chronic bronchitis and early stages of whooping cough, stimulant; reduces lochia, relieves pain in gout when applied locally; powder useful in intermittent malarial fever. Also useful in piles, cancerous tumours, leukaemia, etc.

Chemical Constituents : *Aerial parts* contain anhydrodehydrotylophorinine, anhydro-dehydrotylophorinidine, dehydrotylophorine, emetic, skimmianine, tyloindane, tyloindicines A–J, (+)-14-hydroxyiso-tylocrebrine, 4,6-desdimethylisotylocrebrine, 6-desmethyl-tylophorine, 5-hydroxy-o-methyl-tylophorinidine. *Leaves*, *stem*, *root* contain ceryl alcohol, glucose, quercetin, kaemferol, caoutchouc, p-methoxy salicylaldehyde, resin, tannin, α-amyrin, β-amyrin, tetratricontanol, octacosanyl octacosanoate, β-sitosterol, stigmasterol, phytosterol, 2,3,6-7-tetramethoxy-phenanthro[9,10: 6,7] indolizidine (tylophorine), tylophorinidine, tylophorinine. *Leaves* also contain (+)-isotylocrebrine, (+)-septicine. *Root* also contains alkaloid A, demethyltylophorine, demethyl-tylophorinine, γ-fegarine, tylophorinicine.

Chemical structures of some compounds:




*Eclipta prostrata* (L.) L., Mant. Pl. 2: 286. 1771; Roxb., Fl. Ind. 3: 438. 1832; Santap. in J. Bomb. Nat. Hist. Soc. 54: 475-476. 1957; Koyama in Taxon 30: 505. 1981. *Verbesina prostrata* L., Sp. Pl. 902. 1753. *V. alba* L., Sp. Pl. 902. 1753. *Eclipta erecta* L., Mant. Pl. 2: 286. 1771, *nom. illegit*; Duthie, Fl. Upp. Gang. Pl. 1: 468. 1918. *E. alba* (L.) Hassk., Pl. Jav. Rar. 528. 1848; Hook. f., Fl. Brit. India 3: 304. 1881; Prain, Bengal Pl. 1: 610. 1903; Bennet, Fl. Howrah Dist. 381. 1979.( ASTERACEAE)

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| Local name : | "Kesut". |

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| Description Prostrate, decumbent-ascending or erect annual, strigose herb, much-branched or rarely unbranched, lower nodes rooting, branches reddish, 15-30 cm long. Leaves opposite, subsessile or shortly petioled, 0.5-5.5 x 0.3-1.8 cm, elliptic, elliptic-lanceolate, oblong or oblong-lanceolate, acute or shortly acuminate at apex, narrowed at base, margin subentire or faintly serrate, stiffly appressed pilose on both surface. Heads one or two in a node, heterogamous, radiate, 0.6-1 cm across; peduncle very short to 1.2 cm long. Phyllaries 6-9, ovate-lanceolate herbaceous, appressed pilose, small or large, 2-6 mm long; disk florets about 20-25. Florets white. Ligulate corollas of ray-florets 2.5-3 mm long, 2-dentate. Corolla of disc-florets 1.5-2 mm long, tubular, 4-toothed. Achene obovate-oblong, 2-2.5 mm long, compressed. Pappus 0 or few minute scales. | |
| Fl. & Fr. : | Throughout the year. |
| Chromosome Number 18, 22 Mohan, K.V.J. et al. 1962;<br>22 Arano, H. 1962, Sharma, A.K. & Varma, B. 1960. | |
| Ecology : | Very common in damp waste lands, low water-logged areas, margin of tank, pools, ponds, canals, paddy fields, side of drain etc. |
| Distribution : | Very common, throughout the district. |
| Part used : | Whole plants, leaves, root. |
| Properties : | *Plant* is bitter, acrid, thermogenic, expectorant, alternative, anti-inflammatory, anthelmintic, anodyne, vulnerary, ophthalmic, digestive, carminative, haematinic, diuretic, aphrodisiac, trichogenous, deobstruant, depurative, febrifuge. |
| Uses *Whole plant* considered as an effective drug for hepatotoxicity; deobstruent in hepatic and spleen enlargement, emetic, tonic; juice with honey given to children for catarrh and with castor oil for expulsion of worms; aphrodisiac; beneficial in jaundice and skin diseases. Plant also useful in asthma, elephantiasis, inflammations, gastropathy, anorexia, ulcers, ophthalmopathy, debility, hypertension, strangury, leprosy, pruritus, fever, odontalgia, otalgia, cephalalgia.<br>*Leaves* extensively used in hair oil; decoction used in uterine haemorrhage; paste used as remedy for scorpion sting; anti-inflammatory. | |

Chemical Constituents *Leaves*/*aerial parts* contain Ecliptal (a terthienyl aldehyde), α-terthienyl-methanol, sixteen polyacetylenic thiophenes (I-XVI); 5´-senecioyloxymethylene-2-(4-isovaleroxybut-3-ynyl) dithiophene (II), 5´-tigloyloxyme-thylene-2(-4-isovaleryloxybut-3-ynyl) dithiophene (III); luteolin-7-o-glucoside; wedelolactone, desmethyl wedelolactone and its 7-o-glucoside; nicotine; β-amyrin, stigmasterol.

*Roots* contain 5´-isovaleryloxymethylene-2-(4-isovaleroxybut-3-ynyl) dithiophene (I); heptacosanol, hentriacontanol, stigmasterol etc.


*Grangea maderaspatana* (L.) Poir. in Lam., Encycl. Suppl. 2: 825. 1811; Clarke, Comp. Ind. 37. 1876; Hook. f. in Hook. f., Fl. Brit. India 3: 247. 1881; Prain, Bengal Pl. 1: 593. 1903; Bennet, Fl. Howrah Dist. 376. 1979. *Artemisia maderaspatana* L., Sp. Pl. ed. 2. 1190. 1763. (ASTERACEAE)

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| Local name : | "Namuti". |

Description Prostrate or suberect, aromatic, villous, annual herb, 10-30 cm long. Leaves alternate, sessile, 4-8 cm long, higher ones much smaller, lyrate-pinnatified or almost bipinnatified, coarsely pubescent on both surface; lateral segments distinctly toothed or 3 or 5-lobed, subacute or obtuse at apex. Heads heterogamous, solitary, 6-10 mm in diam; 4-5 mm long, yellow; peduncle short. Phyllaries obovate, with scarious margins, pubescent; receptacle convex, naked; outer florets female 1-or more seriate; disk florets bisexual, all fertile. Corolla of female florates ca 2.5 mm long, hermaphrodite ones ca 2 mm long. Achenes ca 2.5 mm long, compressed, pale brown. Pappus whitish, connate into a fimbriate cup.

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| Fl. & Fr. : | Dec.-May. |

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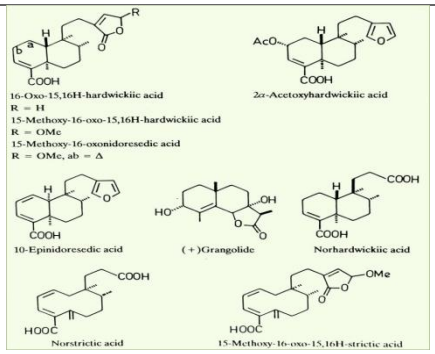
| Chromosome Number 18 Mitra, J. 1947, Mehra, P.N. & Remanandan, P. 1974; Peng, C.-I & Hsu, C.-C. 1977, 1978. | |
| Ecology : | Commonly found in harvested rice-fields, margins of tanks and pools, canals etc. |
| Distribution : | Very common, throughout the district. |
| Part used : | Whole plant and leaves. |
| Uses *Whole plant* stomachic and uterine stimulant.<br>*Leaves* infusion of leaves considered antispasmodic and deobstruent; added with ginger and sugar applied in dyspepsia, hysteria and obstructed menses; externally used for giving relief to physical pain. | |
| Chemical Constituents *Whole plant* contains auranamide; chondrillasterol, chondrillasterone; centipedic acid, hardwickiic acid and its 1,2-dihydro derivative (diterpenes), clerodatetraene; ent. 15,16-epoxy-1,3,13(16), 14-clerodatetraen-18-oic acid(I) 3(R)-hydroxy-8-acetoxypen-tadeca-1, 9(Z), 14-trien-4, 6-diyne, strictic acid and the corresponding 15,16-butenolides, isolated as their methyl esters: 2α-acetoxyhard wickic acid, 10-epic-nidoresedic acid, 16-oxo-15, 16H-hardwickiic acid, 15-methoxy-16-oxo-15,16H-hardwickiic acid, 15-methoxy-16-oxo-nidoresedic acid, 15-methoxy-16-oxo-15, 16H-strictic acid, norhardwickiic acid and nor-strictic acid; p-hydroxy benzoic acid; phenylalanine derivative; lupeol, phytol, allergenic eudesmanolides: (-) frullanolide; (-) 7α-hydroxyfrull-anolide, (+)11α, B-dihydro-3α, 7α-dihydroxyfrullanolide (+) grangolide; hispidulin, kaempferol, luteolin, quercetin, scutellarein etc. | |
| Chemical structures of some compounds: | |




*Parthenium hysterophorus* L., Sp. Pl. 988. 1753; Woodson *et al*. in Ann. Missouri Bot. Gard. (Fl. Panama) 62: 1094. 1975; Paria & Chattopadhyay, Fl. Hazaribagh Dist. Vol. II. 900. 2005. (ASTERACEAE)

Description Puberulous, annual, erect herb, 10-50 cm. Stems much-branched. Leaves alternate, pinnately dissected, to 16 x 9 cm, strigillose on both surfaces, segments opposite to subopposite, lanceolate-oblong, decurrent at base, entire or lobed; petiole to 4.5 cm long. Heads, 4-7 mm across, heterogamous, born in dichotomous, lax, terminal panicles. Involucre campanulate; phyllaries 2-seriate, narrowly ovate, 1.5-2 mm long; inner phyllaries each attached adaxially to base of a ray-floret, two disc paleas and two included sterile disc florets also attached to base of the ray floret on adaxial side. Paleas elliptic, fimbriate at apex. Ligulate corollas ovate, emarginate 0.5-0.7 mm long. Corolla of disc florets narrowly funneliform, 0.5-0.6 mm long. Achenes 1.8-2 mm long. Pappus of 2 broad awns of 0.5 mm long.

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| Fl. & Fr. : | Almost throughout the year, but chiefly during July-Nov. |

Chromosome Number 18 Hakoo, M.L. 1963;
32 Kanchan, S.D. & Geetha, K.S. 1977;
34 Rollins, R.C. 1946; Gupta, R.C. & Gill, B.S. 1980.

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| Ecology : | Common in waste places, roadsides, along railway tracks, garden land etc. |
| Distribution : | Very common, throughout the district. |
| Part used : | Whole plant and root. |

Uses *Whole plant* analgesic, emmenagogue, febrifuge and tonic.
*Root* decoction in dysentery.

Chemical Constituents *Plant* contains bornylacetate, coronpilin, dihydroisoparthenin, hysterin, parthenin (parthenecin), an α-methylene-γ-lactonic sesquiterpene, tetraneurins A,B,C,D; phenylacetonitrile; hexacosanol; myricyl alcohol; galactose, glucose; 6-hydroxy-kaempferol-3, 7-dimethylether, kaempferol, quercetagetin-3,7-dimethyl ether and a quercetin-3-o-glycoside; betulin, ursolic acid and a saponin composed of oleanolic acid and glucose; campesterol, β-sitosterol and stigmasterol, C19 to C35 n-alkanes of which hentriacontane and nonacosane are major components.

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| *Flowers* contain ambrosanolides 2β- and 8β-hydroxycoronopilin, 11H, 13-hydroxy parthenin. Pollen contain aminocaprylic acid,arginine, histidine, methionine, proline etc. |

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| *Sphaerranthus indicus* L., Sp. Pl. 927. 1753; Hook. f. in Hook. f., Fl. Brit. India 3: 275. 1881; Prain, Bengal Pl. 1: 601. 1903; Bennet, Fl. Howrah Dist. 370. 1979. (ASTERACEAE) | |
| Local name : | "Mundi". |
| Description Prostrate or decumbent-ascending, aromatic, tomentose or villous herb. Stem divaricately much-branched; branches 30-60 cm long, with irregularly and toothed wings. Leaves alternate, sessile, 2-5 x 1-2 cm, obovate-oblong, obovate-spathulate, obtuse or slightly rounded with spinous tip at apex, attenuate, semiamplexicaul and decurrent at base, margin toothed with spinous tips. Heads 1.2-1.6 cm long, 1-1.3 cm in diam., compound, reddish-brown; individual heads heterogamous; peduncles winged, subtending bracts linear, shorter than the heads, ciliate at apex. Florets purplish. Female florets 12-16; corolla tubular. Hermaphrodite florets 2-3. Ovary angular; style-arms connate. Achene glabrous, stalked. | |
| Fl. & Fr. : | Nov.-Jan. |
| Chromosome Number 20 Shetty, B.V. 1961; Mehra, P.N. & Ramanandan, P. 1969, 1975. | |
| Ecology : | Found in harvested dry rice field and along field borders, margins of swamp land. |
| Distribution : | Common, throughout the district. |
| Part used : | Whole plant, roots, flowers, seed. |

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| Properties : | *Whole plant* is bitter, acrid, aphrodisiac, carminative, alterative, pectoral, demulcent, anthelmintic, sweet, thermogenic, diuretic, expectorant, febrifuge and stomachic.<br>*Flowers* alterative, blood purifier, depurative, refrigerant and tonic.<br>*Root* anthelmintic and stomachic. |

Uses *Whole plant* is used in piles, gout, rheumatism, calculi, fevers, epilepsy, hemicarnia, jaundice, hepatopathy and gastropathy. A paste of the herbs mixed with oil is good for pruritus and painful swellings, they are useful is strangury, diabetes, leprosy, fever, pectoralgia, cough, gastropathy, hernia, haemorrhoids, helminthiasis, dyspepsia.

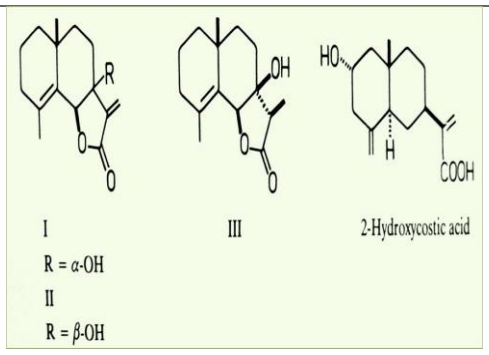
*An oil* prepared by using the root is useful in scrofula.

The powdered *leaf* is good for skin diseases, worms, toxiemia, coughs, scrofula, dysuria, strangury, sexual debility, syphilis etc.

Chemical Constituents *Whole plant* contains β-eudesmol 7-α-hydroxyeudesm-4-en-6, 12-olide (I) and its isomer 7β-hydroxyeudesm-4-en-6-12-olide (II) and a new dihydrolactone (III) and ilicic acid; (24S)-ethyl-cholesta-5,22-dien-3β-ol-β-D-glucoside; sphaeranthine an alkaloid.

*Flowers* contain d-cadinene, β-caryophyllene, citral, eugenol, geraniol, geranylacetate, α and β-ionones, ρ-methoxycinnamaldehyde, methyl chavicol, ocimene, α-phellandrene; indicusene, sphaerene; sphaeranthol, sphaeranthine, α-terpinene; eudesmanolides, viz., 11α, 13-dihydro-3α, 7α-dihydroxy frullanolide, 11α, 13-dihydro-7α, 13-dihydroxyfrullanolide and 11α, 13-dihydro-7α-hydroxy-13-methoxyfrullanolide, three hydroxy lactones, with Δ4.5-eudesmane skeleton containing 7β-hydroxy-6,7-α-methylene-γ-lactone and its c-7 epimer and 7β-hydroxy-6,7-α-methyl-γ-lactone moieties; hentriacontane, n-pentacosane, n-triacontanol; phenylurethan, β-sitosterol and its β-D-glucoside, stigmasterol.

Chemical structures of some compounds:

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| *Spilanthes calva* DC., in Wight, contrib.. Bot. India 19. 1834; Koster & Philipson in Blumea 6: 354. 1950; Paria & Chattopadhyay, Fl. Hazaribagh Dist. Vol. II. 907. 2005. *S. acmella* (L.) Murr. var. *calva* (DC.) Clarke, Comp. Ind. 138. 1876; Hook. f. in Hook. f., Fl. Brit. India 3: 307. 1881. *S. acmella non* (L.) Murr.: Clarke, Comp. Ind. 138. 1876; Hook. f. in Hook. f., Fl. Brit. India 3: 307. 1881; Prain, Bengal Pl. 1: 614. 1903. (ASTERACEAE) |
| Description Erect-ascending, annual herb, to 30 cm tall. Stems sparsely pubescent, often reddish, much-branched. Leaves opposite, 2-5 x 1-3 cm ovate, ovate-lanceolate, cuneate to abruptly attenuate at base, acute or subacute at apex, margin entire to irregularly subcrenate, pubescent on both surfaces; petiole 0.5-1.5 cm long, pubescent. Heads solitary or subpanicled, ovoid, 0.5-0.8 cm long and 5-7 mm across. Peduncle 3-8 cm long. Phyllaries 1 to sub-2-seriate, oblong-lanceolate, subacute, pubescent, 3-4.5 mm long; receptacle convex, elongate. Ray florets absent or when present minute, 2-fid, yellow. Corollas of disc-florets yellow, 1.5-2 mm long, with 4-5 lobed limb. Achenes oblong or slightly obovoid, truncate, much compressed, nearly glabrous. Pappus absent. |

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| Fl. & Fr. : | July-Nov. |

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| Chromosome Number *S. acmella* (L.) Murr; 14 Malik, N.A. & Ahmad, A.J. 1963;<br>24 Mehra, P.N. et al. 1965;<br>48+2 Coleman, J.R. 1970;<br>52 Gajapathy, C. 1962; Narkhade, M.N. & Phadnis, B.A. 1971. |

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| Ecology : | Found in marshy areas, margin of tanks, pools, borders of rice fields, side of drains etc. |
| Distribution : | Less common, found mainly along Hooghly river belt. |
| Part used : | Whole plant, root, flowers and seeds. |
| Properties : | *Flowers* are pungent, thermogenic, sialagogue, expectorant, analgesic, stimulant, carminative, anodyne, diaphoretic, stomachic, appetizer, febrifuge, digestive. |

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| Uses *Whole* plant antidysenteric; decoction diuretic and lithoutripic; in scabies and psoriasis. *Flowers* are used in sore throat, cough, toothache, migraine, dyspepsia, inflammations, |

anorexia, indigestion gum troubles. Flower heads are chewed to relieve toothache, headache, paralysis of the tongue, bronchitis, asthma, stammerring, sexual debility.

*Root* purgative.

Chemical Constituents *Whole plant* contain myricyl alcohol, palmitic and stearic acid; α & β-amyrins and their esters with acetic, lauric, linoleic, linolenic, myristic, palmitic acids, β-D(+)-glucosides of β-sitosterol and stigmasterol; apigenin-7-neohesperidoside, quercetin-3-glucoside, rutin.

*Flowers* contain N-isobutyl-2,6,8-decatrienamide (spilanthol), sesquiterpenoids: eudesmanolide and polygodial.

*Leaves* contain amino acids, α & β-carotenes.

*Tridax procumbens* procumbens L., Sp. Pl. 900. 1753; Clarke, Comp. Ind. 142. 1876; Hook. f. in Hook. f., Fl. Brit. India 3: 311. 1881; Prain, Bengal Pl. 1: 618. 1903; Bennet, Fl. Howrah. Dist. 381. 1979. (ASTERACEAE)

Description Procumbent-ascending, hirsute, annual herb; stem 20-55 cm long. Leaves opposite or sometimes alternate above, 2-4 x 0.6-3 cm, subfleshy, ovate or ovate-lanceolate, acute to subacuminate at apex, cuneate at base, margin irregularly dentate; petiole 5-10 mm long. Heads terminal, solitary, long-peduncled, heterogamous, 10-12 mm long, 8-10 mm in diam.; peduncles 10-30 cm long, slender, hirsute and glandular. Outer phyllaries greenish, ovate, acuminate, herbaceous, hirsute, 3-5 mm long; inner phyllaris oblong-lanceolate, membranous, 5-6 mm long. Ray-florates 5-6; corollas ligulate, pale yellow, obovate-oblong, 6-8 mm long, 2-3 lobed at apex. Corolla of disc florets bright yellow, 4.5-5 mm long, with pubescent, recurved segments. Achenes narrowly obconic, truncate at apex, 2-2.5 mm long, blackish, sericeous. Pappus of numerous unequal, 4-6 mm long, feathery bristles.

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| Fl. & Fr. : | Almost throughout the year. |
| Chromosome Number 36 Raghavan, T.S. & Venkatasubban, K.R. 1941. Harvey 1966. Singh, N.K. 1972; Bir, S.S. & Sidhu, M. 1980. | |
| Ecology : | Commonly found in roadsides, grassy waste places, along railway tracks etc. |
| Distribution : | Common, throughout the district. |
| Part used : | Leaves. |
| Uses *Leaves* antidirrhoeal and antidysenteric; useful in bronchial catarrh; juice is stypic and controls bleeding wounds. | |
| Chemical Constituents *Plant* contains n-alkanes (C15-C32), saturated and unsaturated fatty acids (C12-C22), arachidic, behenic, lauric, linoleic, linolenic, myristic, palmitic, palmitoleic and stearic acids, dotriacontane, 1(2,2-dimethyl-3-hydroxypropyl)-2-isobutylphthalate, heptacosanyl-cyclohexane carboxylate, 12-hydroxytetracosan-15-one, methyl-14-oxooctadecanoate, methyl-14-oxononacosanoate, 3-methylnonadecylbenzene, 32-methyl-30-oxotetratriacont-31-en-1-ol, 30-methyl-28-oxodotriacont-29-en oic-acid, 9-oxoheptadecane, 10-oxononadecane; β-amyrin, β-amyrone, Δ12 -dehydrolupen-3-one, lupeol; fucosterol and β-sitosterol.<br>*Flowers* contain glucoluteolin, luteolin, isoquercetin and quercetin.<br>*Leaves* contain fumaric acid. | |
| Chemical structures of some compounds: | |

*Wedelia chinensis* (Osbeck) Marr., Philipp. J. Sci. 12: 111. 1971; Grierson in Dassn. & Fosb., Rev. Handb. Fl. Ceylon 1: 215. 1980. *Solidago chinensis* Osbeck, Dagbok Ostind. Resa. 241. 1757. *Verbesina calendulacea* L., Sp. Pl. ed. 2, 1272. 1763. *Wedelia calendulacea* (L.) Less.,

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| Syn. Gen. Comp. 222. 1832, *non* Pers. 1870; C.B. Clarke, Comp. Ind. 136. 1876; Hook. f. in Hook. f., Fl. Brit. India 3: 306. 1881; Prain, Bengal Pl. 1: 611. 1903; Bennet, Fl. Howrah Dist. 382. 1979. (ASTERACEAE) | |
| Local name : | "Bhringaraja". |
| Description Procumbent or decumbent or suberect herb, young part puberulous; stem and branches to 80 cm long, rooting at the lower nodes. Leaves opposite, 2-6 x 1.5-2.5 cm, subsessile, thick, scaberulous, oblanceolate or obovate, obtuse or rounded or rarely acute at apex, narrowed at base, margin subentire or upper half crenate-serrate, shortly appressed hispid on both surfaces. Heads solitary, axillary, heterogamous, radiate, 1-1.6 cm in diam., yellow; peduncle 3-12 cm long. Phyllaries obovate-oblong, longer than disk florets. Ray-florets 8-12; basal tube ca 12 mm long, ligule 5-6 mm long, 2-3 dentate at apex. Corolla of disc-florets yellow, 3-3.5 mm long. Achene dark-brown, slightly pubescent, tapering. Pappus a minute irregularly margined withered cup at maturity. | |
| Fl. & Fr. : | Jan.-Aug. |
| Chromosome Number 50 Mehra, D.N. & Remanandan, P. 1969, 1974. | |
| Ecology : | Found in shady grassy localities, river bank etc. |
| Distribution : | Rare, found only along Hooghly river tracks. |
| Part used : | Whole plants, leaves and root. |
| Properties : | The *plant* is astringent, bitter, acrid, thermogenic, anti-inflammatory, ophthalmic, cardio tonic, anthelmintic, diuretic, aphrodisiac, sudorific, febrifuge and trichogenous. |
| Uses *Plant* is useful in inflammations, elephantiasis, otalgia, cephalalgia, wounds ulcers, nyctalopia, dysopia, hepatosplenomegaly, colic, dyspepsia, helminthiasis, strangury, anaemia seminal weakness, fever, baldness and greyness of hair. The plant is very specific for viral hepatitis; beneficial in uterine haemorrhages, menorrhagia; decoction used as deobstruent.<br>*Leaves* alternative, tonic, useful in alopecia, cough, cephalagia and skin diseases.<br>*Root* in combination with other ingredients beneficial in uterine troubles. | |

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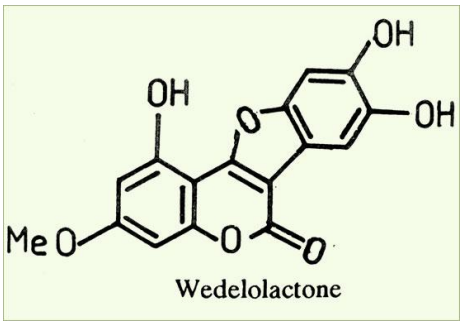
| Chemical Constituents *Leaves* contain lactone of 5,6-dihydroxy 2(2,6-dihydroxy-4-methoxyphenyl) benzofuran-3-carboxylic acid (wedelolactone), nor-wedelic acid, ginsenoside R0 (Chikusetsusaponin V), β-D-glucopyranosyl 3β-[o-β-D-xylopyranosyl)-(1→2)-(β-D-glucuronopyranosyl)]-olean-12-en-28-oate.<br>*Plant* also contain lignoceric and melissic acid, (-)-kaur-16-en-19-oic acid; carotene; demethyl wedelolactone, wedelolactone; stigmasterol and its gluccoside, tannin. |
| Chemical structures of some compounds: |




**Chemistry Of Drugs**

Drugs are a way of modifying the chemistry of the body. They can be used to treat diseases and infections, correct imbalances in electrolytes and fluids, or alter mental status (such as inducing amnesia or stopping hallucinations). Drugs are used both for medical purposes and for recreation. In both cases, no drug is perfect. A perfect drug would be 100% effective while causing no side effects. Drugs offer many benefits, but there are always trade-offs and risks to consider.

**Drug Development**

Early medicine depended on observation and inferring causal relationships. If someone got sick and eating a particular root made them healthy again, she might eat the same root again the next time she was ill. As a result, traditional medicines from any culture are a mix of compounds that are proven effective and used in modern drugs, utter nonsense that only works because of the placebo effect, and everything in between. Sometimes, the mechanism for a drug remains unknown, even after that drug has been approved, marketed, and prescribed to millions of people.

Modern drug development often starts with a deep understanding of pathophysiology. Many diseases are understood at the organ level, or even at the cellular level. Knowing how the disease affects the body lets researchers postulate mechanisms for stopping or reversing the disease process. It gives researchers specific types of cells, receptors, or processes to target.

**Natural Products Chemistry**

Most drugs are originally derived from a natural source, such as a plant or fungus. Aspirin's precursor can be extracted from the bark of a willow tree, for example, while the poppy species *Papaver somniferum* is the source of both pain medications like morphine and illegal substances like heroin. *Ontains*

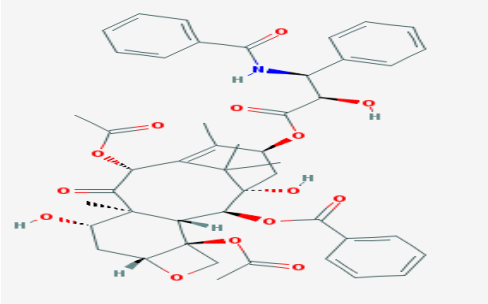
Many drug products are still derived from ancient medicinal compounds or from newly discovered plants, animals, or fungi. Ethnopharmacology is often the first step in drug development. Researchers travel into a remote area, such as a jungle or rainforest, and study the medicinal remedies used by the native people in the region. They take new species of plants or animals back to their laboratories so they can determine what chemical compounds are giving the desired effects, isolate those compounds, and try to synthesize them in larger yields. The chemical structure may be altered to increase the efficacy of the drug while decreasing undesirable effects.

Ethnopharmacology illustrates the importance of preserving diverse ecosystems from a medical or economic perspective, in that the secrets to curing devastating diseases may be hidden in the flora and fauna. However, tying ecological preservation to human gain can create tension once a natural product of interest is discovered, if there appears to be a tradeoff between protecting the species in question and performing research to improve human lives.

Paclitaxel is a chemotherapy agent that was discovered in the 1970's and named after its source, the bark of the Pacific yew, or *Taxus brevifolia*, a tree indigenous to the northwestern United States. Paclitaxel and similar agents, called taxanes, play a central role in treating many common types of cancer, including ovarian, breast, lung, prostate, bladder, head, and neck cancers.

The Pacific yews are slow-growing trees, and they are also home to an endangered species of spotted owl. Given the complexity of paclitaxel's structure, early attempts to synthesize the compound in a lab setting failed. It looked like society would have to choose between the cancer therapy and the forest.

In 1993, a research team studying taxanes discovered that it was not the bark of the yew that produced paclitaxel, but a fungus growing on the bark, and they discovered a way to culture the fungus without the bark.[2] Returning to study the bark, rather than working with the decades-old assumption that the bark produced paclitaxel, allowed cancer research to continue



without threatening an endangered species.*Paclitaxel* [3] *has the molecular formula C_{47}H_{51}NO_{14}C47H51NO14 and a molecular weight of 854 g/mo*

**Pharmacodynamics**

Pharmacodynamics is the study of the effects a drug has on the human body. For example, morphine reduces pain. Many drugs function at a cellular level, binding to receptors on the membrane to modify the cell's activity.

An agonist binds to the same site as the natural ligand that would bind to the receptor and produces the same effect. Many pain medications are opioid agonists: they bind to the same opioid receptors that natural endorphins do, producing analgesia and a sense of wellbeing.

*Partial agonists* produce the same effect, but to a lesser degree than a *full agonist*. Buprenorphine is a partial opioid agonist. It can be used to treat pain, the same way a full agonist would. It can also be used to treat opioid addictions. Buprenorphine gives an addicted individual relief from the physical symptoms of drug withdrawl but does not produce the same level of euphoria as heroin, for example.

An antagonist binds to the same site on the receptor as the natural enzyme, but it does not produce the same effect. Naloxone is an opioid antagonist that binds to opioid receptors more strongly than the agonists do. It is used to reverse the effects of an opioid overdose, including the slowed breathing that can lead to death.

Both agonists and antagonists can be *reversible* (impermanent) or *irreversible* (permanent) in how they bind to the target receptor.

**Pharmacokinetics**

Pharmacokinetics is the study of the effects the human body has on a drug. There are four basic pharmacokinetic processes: *absorption*, *distribution*, *metabolism*, and *excretion*.

Absorption refers to how well the drug enters the body and the bloodstream. Many drugs are administered through the gastrointestinal tract, and the pH of the stomach and intestines affects how well the drugs are absorbed. Parenteral drugs are injected directly into the bloodstream (intravenous or IV), muscle (intramuscular or IM), or fat tissue (subcutaneous or SQ).

The exact same tablet of a pain medication can affect the body differently depending on how it is administered. The tablet will decrease pain and cause no euphoria if it is taken by mouth, as prescribed. However, the tablet can be abused to alter the absorption. If it is insufflated instead, the effects have less to do with pain and more to do with an altered mental status, because the drug is available more immediately.

Absorption determines the bioavailability of the drug, the percentage that reaches the bloodstream in its active form and is therefore accessible to other tissues.

Distribution describes how a drug moves from the bloodstream to various body tissues. Drugs concentrate in different tissues (fat, muscles, blood, organs, bone, etc.) depending on several factors, the most common being

1. whether they are more water-soluble or fat-soluble;
2. how strongly they bind to proteins in the bloodstream.

Changing the functional groups on a drug can make it distribute better into a particular tissue. For example, heroin is diacetylated morphine. The acetyl groups help the drug move faster across the brain's defense system, the blood-brain barrier. People feel more euphoria from

heroin than they do from the same amount of morphine because heroin distributes to the brain better.

Bayer, the same drug company that makes aspirin (acetylsalicylic acid), launched heroin as a commercial product in 1898. Acetylation had decreased the side effects of salicylic acid, including nausea and vomiting. The drug company hoped the same would be true of morphine, and they originally marketed heroin as a treatment for lung diseases like tuberculosis. Unfortunately, heroin actually *decreases* respiratory function even more than morphine, and the acetylation (and faster access to the brain) makes it more addictive, a lethal combination. Medicinal use of heroin was banned in the United States in 1924.

Metabolism takes place primarily in the liver. Lipid-soluble compounds are converted to water-soluble compounds so they are better excreted by the kidneys. CYP enzymes are extensively involved in metabolizing drugs.

Excretion refers to how a drug is eliminated from the body. Most excretion occurs through the urinary-system or the biliary system.

Pharmacokinetic factors can be modified to create a drug that is more effective or has fewer side effects. If a drug is quickly metabolized to a compound that causes a side effect, for example, the chemical structure might be altered so the drug metabolizes more slowly or is eliminated more quickly.

**Illicit Drugs**

Often, the chemical traits or physiological effects that make drugs of abuse attractive to users are the same things that make them dangerous. The desired effects cannot be separated from the adverse effects, because they are caused by the same chemical interactions.

For example, cocaine works as an anesthetic, decreasing the body's response to pain. This causes a feeling of euphoria that recreational users enjoy, but it can also lead to lung damage. Users do not realize that the material they are smoking is still on fire, and they can burn their mouth, larynx, and lungs as a result. Cocaine is a stimulant, and people enjoy the feeling of energy that it gives them. However, stimulants increase heart rate, blood pressure, and temperature, which can lead to a heart attack or similar crisis that lands the user in the emergency room. Some work as narcotics.

## FUTURE OF PHARMACOGNOSY

Medicinal plants are of great value in the field of treatment and cure of disease. Over the years, scientific research has expanded our knowledge of the chemical effects and composition of the active constituents, which determine the medicinal properties of the plants. It has now been universally accepted fact that the plant drugs and remedies are far safer than that of synthetic medicines for curing the complex diseases like cancer and AIDS. Enormous number of alkaloids, glycosides and antibiotics have been isolated, identified and used as curative agents. The modern devel-opments in the instrumental techniques of analysis and chromatographical methodologies have added numerous complex and rare natural products to the armoury of phy-tomedicine. To mention a few, artemissinin as antimalarial, taxol as anticancer, forskolin as antihypertensive, rutin as vitamin P and capillary permeability factor and piperine as bioavailability enhancer are the recent developments. Natural products have also been used as drug substitutes for the semisynthesis of many potent drugs. Ergotamine for dihydroergotamine in the treatment of migraine, podophyl-lotoxin for etoposide, a potent antineoplastic drug or sola-sodine and diosgenin that serve for the synthetic steroidal hormones are the first-line examples of the recent days.

In the Western world, as the people are becoming aware of the potency and side effects of synthetic drugs, there is an increasing interest in the plant-based remedies with a basic approach towards the nature. The future developments of pharmacognosy as well as herbal drug industry would be largely dependent upon the reliable methodologies for identification of marker compounds of the extracts and also upon the standardization and quality control of these extracts. Mother earth has given vast resources of medicinal flora and fauna both terrestrial and marine, and it largely depends upon the forthcoming generations of pharma-cognosists and phytochemists to explore the wonder drug molecules from this unexploited wealth.

Little more needs to be said about the present-day impor-tance of medicinal plants, for it will be apparent from the foregoing that the plant themselves either in the form of crude drugs or even more important, for the medicinally active materials isolated from them, have been, are and always will be an important aid to the physician in the treatment of disease.