Review of Literature
REVIEW OF LITERATURE

Historical Account:

Since the dawn of human culture man is using natural resources around him for health care. Longevity and eternal health has always remained his esteemed dream. Search for the remedy to relieve pain and discomfort prompted man to develop diverse ways and means of health care. He developed various therapeutic agents and tonics. Over millennia that followed, the most effective agents amongst them were selected by the process of trial and error. The practice is generally termed as 'Traditional Medicine'.

Today there is a renewed interest in traditional medicine. The promotive and preventive medicines widely prevalent in oriental systems, especially the Indian - i.e. Ayurveda, Siddha and Unani and Chinese Systems of Medicine are finding increasing popularity and acceptance in the developing and developed countries. Jaggi (1976) took review of the history, concepts, diagnosis, treatment, modern trends and scope of Indian Traditional System.

The glorious era of Unani Medicine in which it was formulated as a definite branch of study starts with Hippocrates (460-377 B.C.). He gave a new turn to medicine by recognising the real causes of health and disease on rational basis and wrote several books on different medical issues.

Dioscoridies (40-90 A.D.) was the notable scholar and physician of the first century who is referred to as the father of herbal drugs. His work 'Kitab-al-Hashish' (Arabic translation) is the most celebrated work in pharmacology. The work deals with
more than 600 herbal drugs. This work was hailed as primary source of pharmacology for centuries.

Soranus of Ephesus (98-138 A.D.) was a renowned physician of his age. He is acknowledged as a specialist in gynaecology, obstetrics and paediatrics. His work 'Diseases of Women' (English version) is acclaimed to be the first book on obstetrics, gynaecology and paediatrics.

Galen (130-200 A.D.) was great Roman physician. He was pioneer of anatomy and a scholar of pharmacology. His 'Kitab-al-Adwiyah-al-Mufrada' (Arabic translation) consist of 11 treatises.

Paul of Aagenate was a famous Greek Physician of the Byzantine era (676-732 A.D.). He was famous as a noted obstetrician in the Muslim medical circles. His writings 'Kunnash Fi Tib' and 'Kitab Fi Illal - Al - Nisa' were translated and commented upon in English by Dr. Francis Adams and he published it in 3 volumes.

During Abbasid period (750-850 A.D.) there began an organized attempt to the pursuit of scientific learning. The procurement and translation of Greek medical and other texts, as well as those of India, was taken up as organized work supported by the caliphs Harun-al-Rashid (786-809 A.D.) and his son and successor al-Mamum (813-833 A.D.) wrote 'Khalq aljanin wa Tadbir al Habala wa al Maullodeen' in 965 A.D. It is the first Arabic Medical Treatise written in Spain. Henry Jaheer and Abdul Qadir Nooruddin explored this work and published it in 1956 from Algeria.

Al-Razi (850-925 A.D.) was probably the greatest and the most original of all Muslim physicians and one of the most prolific writers. On the basis of the existing knowledge of all diseases available from all authors of antiquity, mostly Greek,
and also others including Indian, coupled with his own observations, he composed a huge manuscript, which was published after his death under the title of 'al-Hawi', in Latin called Continens. It was later translated into Latin and other European languages and was taught in European Universities and influenced western medical thinking.

Another great physician was Ibn Sina also known by his Latinized name, Avicenna (980-1037). His book 'al-Qanun' in Latin called 'Canon' attained great fame and was translated into Latin and was used in Medieval European Universities. It is still regarded as the supreme authority on all matters connected with Unani Medicine.

Unani Medicine has benefited from other systems of medicine during its long course of development, Ayurveda being one of such systems. Ali b. Rabban Tabri was the first Unani Physician who devoted a long chapter on Ayurveda in his book 'Firdaus al-Hikmat'. Razi (926 A.D.) and Ibn Sina (1037 A.D.) also dealt with the Indian medicine, and a number of references are extant in their books, particularly 'Al-Hawi and Al-Qanun'. The influence of Ayurveda is well marked on the books "Indian Hakims" as well e.g. 'Rahat al-Insan' by Ilyas Shahab alias Zia, 'Majnu-i-Zia' by Zia Mohammed alias Mubarkbad (1351 A.D.), 'Madan-al-Shifa Sikandar Shahi' by Bahwa b. Khawas Khan, 'Dastur al-Hunud' by Amanullah Khan (1637 A.D.), 'Tibbi-i-Dara Shikuni' by Nuruddin Mohammed Abdullah (1648 A.D.) and 'Talif-i-Sharifi' by Hakim Sharif Khan. (Azami A.A. 1998)

Modern Scenario:

The emphasis laid by WHO on the study of medicinal plants is increasingly growing world over. Government of India also attaches great importance to this aspect.
Like biological diversity, there is great cultural diversity in India. Number of tribes and societies live in this country with their own cultural and knowledge heritage. Every tribe and society has its own traditional health system in which various herbs, minerals and even animals are used in drug preparation. Ministry of Environment and Forests launched an All India Co-ordinated Research Project on Ethnobiology in 1982, involving 24 Research centres in the country. First two phases of the project has been completed and the outcome is really fantastic. Over 9,500 wild plant species, used by different tribals for meeting their varied requirements have been recorded (Anonymous, 1994).

Central Council for Research in Unani Medicine is an autonomous organization of Ministry of Health and Family Welfare. The Council was established in the year 1978 with the objective of undertaking multifaceted research activities in Unani medicine. The council is primarily engaged in clinical research work, has now focused attention on the important areas of Drug standardisation and survey of Medicinal plants, particularly in view of the fact that genuine natural drugs are the basic necessity of a dependable therapy. Different forest regions of the country are continuously surveyed for collection of Unani Medicinal plants. Southern area was explored by Nayar and Khalleefathullah during 1984 to 1988. A monograph of about 79 taxa of medicinally important plants of the area was published (Nayar & Khalleefathullah, 1992).

Medico-botanical exploration of the flora of Aligarh resulted in about 100 taxa with their medicinal uses. Survey carried out in Gwalior Forest Division brought to light 462 plants used in Unani system of the region. Central Research Institute of
Unani Medicine, Hyderabad conducted surveys to collect the information on Unani medicinal plants from Andhra Pradesh.

Over 1500 single drugs find a mention in the classical literature of Unani medicine, majority of them being of plant origin. At present more than 500 singles are extensively used by the practitioners of this system. To ensure the purity of the drug material its standardization is essential. Central Council for Research in Unani Medicine, New Delhi took up the work of standardization of Unani medicinal plants. Over the period of ten years it produced data on standardization of 150 single drugs. (Anonymous 1982, 92 and 97). Such type of work has been taken first time in the history of Unani medicine.

Many times it is not possible for the people to get experts' help in the time of need, and many times it is the common ailments which go untreated because of negligence, ultimately affecting the person's health. Simple drug formulations that can be made easily available is one of the simple solution to the problem. It is in this context that the Central Council for Research in Indian Medicine and Homeopathy embarked on the programme of preparing "Handbook of simple remedies for common ailments". Council has published a handbook of common Unani remedies (Ummul Fazal and M.A. Razzak, 1976). Book contains every detail of preparation, administration and preservation of compound formulations. The book also includes instructions about hygiene.

A widely but erroneously held belief is that Unani medicine is lacking in discussions on contraception, birth control etc. However the writings of many unani physicians show the keen interest and knowledge they had in beliefs and practices
concerning birth control, pregnancy, delivery etc. Razzak & Ummul Fazal (1993) has compiled information on the subject of family planning as enunciated in classics of Unani system of medicine. Also techniques and devices for birth control as mentioned by Unani physicians are included in the text.

Indian systems of medicine have recognised the importance of the drugs of Zoological origin, right from the very ancient times. The Indian Materia Medica, which includes drugs of Ayurveda - the Indian system of medicine and Unani - the Greco-Arabian system of Medicine, at present has about 2000 drugs, out of these about 200 are obtained from animals. The crude drugs from animals are put to limited usage in Ayurvedic Medicine, only those animal products are used which do not have any physical sign of life. The Materia Medica of Greeks consisted of many substances of animal origin. The Unani system therefore makes extensive use of animals drugs. It has a large number of animal origin drugs which are beneficial or are claimed to be so, in a variety of human ailments. Unani system of medicine assumes that ingestion of animal organ invigorates the corresponding human organ. Modern organ therapy is based on similar assumptions. The difference lies in the form of usage; while Unani medicine uses the whole organs, modern medicine extracts their active principles.

Unani System:

Unani system is based on five fundamental principles, viz. elements (arkhan), temperament (mizaj), humours (akhlat), pneuma (ruh) and governing power of body (tabiat) (Azmi A.A. 1995)
I) According to Unani Medicine there are five elements while modern chemistry has traced about 106 elements, out of which 82 elements are found in human body. Elements play a very important and significant role in health and disease of human beings. They are classified as -

1) Bulk or major elements - viz. hydrogen, nitrogen, carbon, oxygen and sulphur.
2) Microminerals - such as sodium, potassium, calcium, magnesium, chlorine and phosphorus.
3) Trace elements - like iron, iodine, fluorine, copper, manganese, zinc, cobalt, chromium etc.

II) The concept of temperament is quite confusing. It means quality that is described as hot, cold, dry and moist.

III) Humoral doctrine dates back to Hippocrates (377 B.C.). According to this doctrine so long as four humours (blood, phlegm, yellow bile & black bile) remain in equilibrium both in quality and quantity, the body remains in a healthy state.

IV) Concept of pneuma (ruh) is unclear.

V) Concept of tabiat is a seminal concept of Unani Medicine. It is generally regarded as synonymous with the modern concept of immunity but it is more comprehensive than immunity. It deals with the health as well as diseased condition of the body.
Unani Drug Plants:

The literature survey for the information available about the plants studied here, has been made regarding three aspects.

1. Medicinal uses: For all the plants studied here i.e. those included only in survey and also for those whose detailed pharmacognostic studies were made. Earlier recorded uses of the plants are given in text only, for the convenience of comparison.

2. Micromorphology: i.e. anatomical information; mainly availed from publications by Metcalfe and Chalk (1972) and Solereder (1986).

3. Phytochemistry:

Later two aspects are reviewed for those species only, for which, such study has been carried out in the present work.

Micromorphology:

Malvaceae are characterized by stellate hairs, mucilagenous cells, dorsiventral leaf and triangular strands of phloem in axis. Calcium oxalate crystals either solitary or clustered present. Petiole usually with a ring of vascular bundles. The phloem is characteristic consisting of triangular strands with bases towards the xylem. Vessels very small to medium.

In Abutilon, petiole exhibits an interrupted ring of wood. Luckan (1917) reported water absorbing hairs on the leaf. Types of hairs occurring in the family are very diverse. In species of Abutilon, they are formed by a filament of cells, of which uppermost cell is somewhat enlarged. Mucilagenous cells present; more abundant in young stem in case of A. insigne. Vessels very small to moderately small. Xylem
parenchyma vascicentric to slightly aliform.

_**Zygophyllaceae**_ are reported to show unicellular simple or rarely armed hairs, centric mesophyll partly composed of water storage cells, in certain species, vein bundle sheaths chlorenchymatous; stomata anomocytic and presence of clustered crystals.

Recently _**Geraniaceae**_ are splitted into three independent families, Geraniaceae, Oxalidaceae and Balsaminaceae. _**Biophytum**_ has been placed under Oxalidaceae. No anatomical information about _**Biophytum**_ has been included either by Metcalfe & Chalk or Solereder in their Geraniaceae. However, anatomy of _**Oxalis**, _**Geranium** & _**Pelargonium**_ has been described to certain extent. There is no special type of stomatal apparatus; hairs simple, unicellular or uniseriate and glandular ones with unicellular stalk and unicellular head. Internal schizogenous secretory cavities noted in certain species of _**Oxalis**_. Mesophyll isobilateral. In certain species of _**Geranium**, especially in _**G. phaeum**_; young stem exhibits two rings of vascular bundles. Vessels with simple perforation plate distributed as clusters in _**Geranium**_ and occasional with multiple perforation plate in _**Pelargonium**_.

_**Fabaceae**_ show a considerable range of anatomical variation co-related with wide diversity of habit shown by different genera and species. In fact none of the anatomical characters are sufficiently distinctive to demark the family from other related families (included under Leguminosae) at a glance. Long, stalked glands, mucilagenous epidermal cells, central layers of mesophyll devoid of chlorophyll but filled with tanniniferous contents, presence of rod shaped crystals in palisade and isolated strands of fibres & stone cells in pericycle have been reported from _**Tephrosia**_.

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Caesalpiniaceae are recorded to show various types of trichomes, papillose epidermis and paracytic and anomocytic stomata. Tannin cells absent. Secretory cells, crystals of calcium oxalate and solitary crystals (styloids) are of common occurrence in mesophyll. Mesophyll mostly bifacial. Both normal and anomalous patterns of same structure recorded in the family. Xylem rays 1-7 cells wide or exclusively uniseriate. Vessels typically medium sized.

Previously Aizoaceae was not considered as an independent family, the members were included in Ficoidaceae. They are mostly succulent herbs chiefly occurring in desert regions. Epidermis of both leaf and stem generally includes large bladder like cells, stomata anomocytic and paracytic, mesophyll frequently centric. Anomalous secondary thickening common. Sabnis (1920) recorded isobilateral leaves in Trianthema; chlorophyllose bundle sheaths recorded in Mollugo and Trianthema. He reported palisade tissue of Trianthema triquetra confined to arcs of tissue towards lower surface and occurrence of large amount of aqueous tissue.

Asteraceae are a large family and obviously has not been comprehensively surveyed anatomically. However, certain features are of great taxonomic value like secretory canals, laticiferous canals, types of trichomes, anomalous secondary thickening in woody members and occurrence of medullary and cortical bundles. Herbaceous members uniformly have the stems with a ring of colateral vascular bundles accompanied by fibrous strands in pericyclic region. Stomata anomocytic.

Asclepiadaceae show universal presence of laticiferous tubes in both stem and leaf together with the presence of intraxylary phloem. Hairs mostly simple, glands infrequent. Leaf dorsiventral or isobilateral. Stomata variable, frequently paracytic.
Several types of anomalous structures occur in climbing species.


Scrophulariaceae show variable leaf structure mesophyll being dorsivenral, isobilateral or homogenous. Hairs frequently simple and branched, multicellular. Glands variously shaped, peltate glands confined to few genera. Petiole with crescent shaped vasculature, made of single strand or separate bundles. Crystals of calcium oxalate present but rather infrequent.


Martyniaceae are separated from Pedaliaceae on the basis of parietal placentation. However anatomically it is similar to the members of Pedaliaceae (Bhattacharya & Johri, 1998). They are characterized by mucilage hairs. Leaf dorsivenral amphistomatous.

Hairs with long or short stalk and spherical head consisting of cells arranged in a palisade like manner recorded in Martynia along with some others. Stomata
anomocytic; petiole with a sinuously crescentic vascular strand with small accessory bundles on the adaxial side between the ends of the crescent and others in the cortical region on either side of the adaxial groove. Numerous solitary crystals in mesophyll noted by Solereder (1986). Vessels in *Martynia fragrans* Lindl. with wide lumen, irregularly distributed and exhibiting a wide range of size. Pith becoming hollow.

Family **Verbenaceae** shows a wide range of anatomical features because of very diverse habitat in which it grows. Trichomes surrounded by cystolith containing cells, small glandular hairs, stomata on both surfaces of leaf, mesophyll consisting of several palisade layers, petiole with shallow crescentic median vascular strand with accessory bundles in wings, stem with deeply situated cork cambium, wood with medium sized and small vessels have been reported from *Lantana* species.

**Nyctaginaceae** have been studied anatomically from the point of view of understanding the anomalous growth in axis. Development of successive rings of collateral vascular bundles is characteristic. Various explanations are given from time to time, to understand the secondary growth. It is now established that families like Phytolaccaceae, Amaranthaceae, Chenopodiaceae and Nyctaginaceae possess a sort of primary thickening meristem (PTM) which gets established very early i.e. in the seedling (Mikesell and Popham 1973, Mikesell 1979). Dorsiventral leaf, uniseriate hairs with blunt terminal cells and enlarged terminal cells, stomata homocytic distributed on both surfaces. Anomalous secondary thickening present in stem; vessels small; granular crystals noted in *Boerhaavia*. Cells of mesophyll connected to one another by short processes noted in few species of *Boerhaavia*. Sabnis (1921) recorded water storage tissue in lower side of mesophyll in *B. elegans* and *B. verticellata*. Mullan (1932) recorded bundle sheaths with thick walled,
funnel shaped cells containing large chloroplasts surrounding the veins in species of *Boerhaavia* (excluding *B. verticellata*). He also recorded palisade tissue on upper side around the vein in *B. diffusa*.

**Euphorbiaceae** include plants with many diverse habit forms. The anatomical structure exhibits a wide range of variation in co-relation with the diversity of habit and no taxonomically important characters occur throughout the numerous tribes into which the family is divided. Simple and shaggy hairs present in Acalyphae and Phyllanthae. Multicellular stalked glands and spherical disc like sunken glands recorded in *Acalypha* by Pax and Hoffmann (1931). Multicellular branched hairs, mucilaginous epidermal cells, recorded in *Phyllanthus*. Papilllose epidermis present in *Euphorbia*. Single layered hypodermis consisting of large cells on lower side noted in *Euphorbia* and *Phyllanthus*. Acalyphae, Euphorbiae and Phyllanthae show anomocytic stomata, while paracytic stomata recorded in succulent species of *Euphorbia* from Madagascar (Dommel 1910).

Palisade below upper epidermis and around the vein bundles seen in *Euphorbia polygonifolia* by Starr (1912). Sclerenchyma recorded in mesophyll of *Acalypha* and *Phyllanthus*. Spheraphides, sphaerites and crystalloides recorded in the family. Wood structure studied in many members of the family. Laticifers, tannin sacs, resin cells and mucilage cavities present.

**Commelinaceae** show tetracytic or hexacytic stomata; uniseriate glandular as well as non-glandular trichomes; raphides, canals and silica crystals. Vessels with simple perforation plates confined to all organs (Dahlgren et.al 1985)

Sabnis (1921) studied *Commelina albescens*. He noted axis with sclerenchymatous pericycle and vascular bundles opposing the pericycle and scattered in
the medulla. Leaf with armed palisade and bundles accompanied with sclerenchyma on lower side, tannin cells present in mesophyll. Trichomes uniseriate and bracket shaped.

**PHYTOCHEMISTRY:**

_Abutilon indica_ plants contain mucilage, hexoses, n-alkanes, alkanols, β-sisterol, vanillic, p - coumaric, caffeic, fumaric, p - hydroxybenzoic, p- β- D-glucosyloxybenzoic, galacturonic acids. Petals yield cyanidin - 3- rutinoside, gossypetin - 8 and 7 - glycoside. Seed oil is reported to have palmitic, stearic, oleic, linoleic and linolenic acids (Chatterjee and Pakrashi, 1992). Nadkarni (1995) reported tannins, organic acid from leaves and asparagin from roots and leaves. He also reported ash containing alkaline sulphates, chlorides, magnesium, phosphate and calcium carbonate. Rastogi and Mehrotra (1994) reported alantolactone and iso-alantolactone. Baxi and Parikh (1980) reported leucine, histidine, threonine, serine, glutamic acid, aspartic acid and galacturonic acid from the leaves of _A. indicum_ and _A. glaucum_.

Rastogi and Mehrotra (1994) reported tigogenin, hecogenin, gitogenin and terrestriomide from roots, stems, leaves and fruits of _Tribulus terrestris_; while diogenin reported from stem, leaf and fruit. Flowers contain ruscogenin and spirostal -3, 5- diene. Fruits contain alkaloids, fixed oil, resin and nitrates (Chopra et.al, 1996; Nadkarni 1995, Kirtikar and Basu 1935; Chopra et.al 1974) reported occurrence of herman in herb and hermine in seeds. Sharma et.al (2001) report presence of saponins, diosgenin, glycosides, flavonoids, from aerial parts and free amino acids from root.

Roots of _Tephrosia purpuraea_ yield three crystalline compounds - maxima substance A, B & C. Maxima substance C shows isoflavone structure, chemically related
to rotenone. Pods give 'purpurin A', B and maximin. Leaves contain glucoside of rutin (Chopra et al. 1974) β - sitosterol, lupeol, rutin, delphinidin, chloride, cyanidin chloride, (-) isolonchocarpin, lanceolalins A and B, pongamol (lanceolatin C), karangin, kangone, 5,7- dimethoxy -8 (2,3 - epoxy-3- methylbutyl)- flavanone, 2-methoxy-3, 9-dihydroxycoumestone, flevichapparins B & C, methyl karanjic acid and purpurin have been reported, (Chatterjee and S.C. Pakrashi -1994). Isolation of O-methyl-pongamol, lanceolatin B (+) purpurin and maackiain from dried root (Rastogi and Mehrotra, 1994). Roots contain tephrosin, degelnin, isophestoprosin, rotenone etc. Leaves contain about 2% of a glucoside osyritin & glucoside rutin.

*Cassia* species alongwith some other species of Caesalpiniaceae like *Senna* are reported to possess anthraquinones (Dahanukar and Hazra, 2001). Emodin has been reported from roots, leaves and seeds of *C.occidentalis* (Chatterjee and Pakrashi, 1992) and from *C.tora* (Rastogi and Mehrotra, 1994). Seeds and leaves of *C.tora* contain amino acids, fatty acids, chrysophenol, rhein and sisterol. Myricyl alcohol, chrysophenic acid and β- sisterol were isolated from root (Chatterjee and Pakrashi, 1992). Cassiside, rubrofusarin - 6- β- gentioleucoside and naphthopyrone reported by Rastogi and Mehrotra (1994). Flowers contain kaempferol.

*C- flavonosides reported from flowers of C. occidentalis*. Linolic, oleic and tannic acids present in seeds. Leaves yield rhamnosides, rhein and potassium chelidonate. Roots produce chrysophenol , β-sistarol. Emodol, luteolin; quercetin and polysaccharides recorded from plants (Chatterjee and Pakrashi, 1992). Nadkarni (1995) noted seeds to contain margarine, traces of calcium sulphate and phosphate, sodium chloride, magnesium sulphate, iron and silica.
Chatterjee and Pakrashi (1994) reported trianthenin and ecdysterone from plants of *Trianthema portulacastrum*. Chopra et al. (1996) recorded saponins, alkaloid punarnavine and a new alkaloid \( C_{32}H_{36}O_6N_2 \) from the plant.


The neutral portion of *L. aurita* oil has been reported to yield n-heptacosane, n-dotriacontane, \( \delta \)-cadinene, \( \alpha \)-cadinol, m - meth -6- en - 8- ol. A new aromatic ether and a new sesquiterpene secondary alcohol identified as 2,3 dimethoxy-p-cymene and Laggerol (Satyavati and Gupta, 1987). Polyphenolyses, lignins, triterpenoids, alkaloids & catechol present. Phenolic acids - p - OH- benzoic, vanillic, syringic, 3-OH-5OCH3 and O-coumeric acid present.

Amino acids present are L-Lysine monohydrochloride, L-Leucine, DL-valine, DL-isoleucine, L-Tyrosine and Lanthionine. Flavonoids-Quercetin and 3,3',4'-tri O Me Quercetin present. Triterpene profile shows 5 spots, steroid profile shows single spot. (Bhogaonkar and Devarkar, 2002).

*Sphaeranthus senegalensis* plants yield 0.01 % essential oil,(Chopra et al.- Rpr
- 1974). Flavonoids and terpenes also reported (Yoganarasimhan et.al 1985). Three new endesmanolides isolated and characterised, 4- epicryptomeridion and alkaloids and 2-cyclopeptide alkaloids also isolated from flower (Rastogi and Mehrotra, 1994). Stems and flowers contain alkaloid sphaeranthine. Fresh flowering plants yield essential oil (Chopra et.al, 1996). The herb yields a deep cherry-coloured essential oil. Stems, leaves and flowers contain a bitter alkaloid "Sphaeranthine" (Nadkarni, 1976)


Campesterol, stigmasterol and β-sitosterol isolated from unsaponifiable fraction in Tridax (Rastogi and Mehrotra -1994) Xanthium strumarium contains fats, albuminoids, a glycoside xanthostrumanin, organic acids besides sugar, resins etc. Xanthostrumanin is an amorphous yellow glycoside which is soluble in water, alcohol, ether, benzene, chloroform and yields precipitate with group reagents for alkaloids with FeCl₃, lead acetate and with salts of other metals. It is not precipitated by tannin or gelatin. Fruit contain only a fixed oil and a principle which was precipitated by tannin. Seeds contain of a fixed oil which has most of the physical & chemical properties of sunflower seed oil. It contains saturated acids, oleic acid, linoleic acid. The residue after extraction of the oil contains proteins, crude protein, cellulose, fat, extractive substance and ash (Anonymous, 1992).

A new sesquiterpene lactone -2-hydroxymentosin -1β, 5β - epoxide isolated
and its structure elucidated. From fruits polyphenol is isolated and characterised as 1,3,5-tri-o-caffeoylquinic acid along with 3,5 di-O-caffeoylquinic acid. From leaves β-amyrin, octacasonol, stigmasterol and β-sitosterol is isolated (Rastogi and Mehrotra, 1994).

Fruit contains fat, albuminoids, sugar, resin, organic acids (oxalic acid) and a glucoside named "xanthostrumarin" related to datiscin (Nadkarni, 1976).

Seeds contain glucoside xanthostrumarin, oxalic acid; believed to have a second active principle (Chopra et al., 1996).

*Calotropis procera* has been worked out in great details by various authors. Roots, leaves, stems, flowers and latex all are screened thoroughly for phytochemicals. Various flavonoids, alkaloids, cardiac steroids, fatty acids, alkaline phosphatase and various sugars have been reported (Chatterjee et al., 1992). A. Mohammad et al. (1997) recorded amino acids, aspartic acid and leucine from root wood; in addition glutamine from root bark, valine and glutamine from fruits. Leaves and stalk contain calotropin. Latex in addition contains uscharin, calotroxin and calactin.

Plant contains a phytotoxic protein, brutoxin, two antileukemic quassinoic glycosides bruceine A, B, C, D, E, F, G and Q and a lactone. Seeds also have 20% fatty oil and a small quantity of ester and bark, a small quantity of volatile oil. (Jain S.K. and et al. 1991). The latex contains fine cardiac steroid glucosides calotropagenin (Chopra et al. 1974).

Root bark contain alkaloid benzoyllineolone and benzoylisolineolone. Roots, stems, leaves and latex contain β-amyrin. Flowers contain S-rhammoglucoside and evanidin. Plant contain O-pyrocatechuic acid and cardenolides like calotropic, calotoxin, uscharin and uscharidine and base choline. Stem contain alkaloid. Chemical composition
of latex has sterols and triterpenes and also in plant extract present uzarigenin, syriogenin and proceroside in addition to calotropagenin and 6 of its glycosides. Latex and leaves contain cardenolides (Asolkar et.al 1992)


*Martynia* plant contains 5,7, 4'-trihydroxy-3'-methoxy flavone and its 7-0-β-glucuronide reported (Rastogi & Mehrotra, 1994).

*Lantana camara* produces an essential oil containing camerene, isocamerene and micranene (Nadkarni, 1976), Chopra et.al, 1996). Leaves during flowering and seeding stage yield lantanine. Lantana camara leaves contain a new terpenoid - lantadene D; 6 and 7 - methoxy derivatives of diodantunezone and camaronol. Two new carbohydrates - lantanose A and lantanose B - isolated from roots; stachyose, verbasose, ajugose, verbascotetrose and theviridoside also isolated. Oleic acid, lantadene A, lantadene B & lantanilic acid reported from roots. Leaf and stem oil contains geraniol, γ - murolene, β - caryophyllene and limonene; plants from Brazil showed presence of Eugenol in oil.

*Acalypha indica* contains acalyphamide ( as acetate), aurantiamide and its acilate, succimimide, calypholacetate, 2-methyl anthraquinone, tri-O-methyllellagic acid, β-sitosterol and its β-D- glucoside (leaves); stigmasterol from root; a cyanogenetic glucoside, two alkaloids viz. acalyphine and triacetonamine, an essential oil, n-octacosanol, kaemferol, quebrachitol, β - sitosterol acetate and tannin from whole plant (Chatterjee et.al 1997, Asolkar L.V. et.al 1992). Active principle HCN and an unknown substance extremely poisonous to rabbits; causes discoloration of blood and gastro intestinal irritation (Chopra et.al. 1996). Alkaloids "acalypus" and "acalyphine" (Nadkarni, K.M. 1976).
Hentriacontane, myricyl alcohol, β-sitosterol, β-amyrin, friedelin and taraxerol reported from leaves and stem of *Euphorbia hirta*. Bark and latex produces α-amyrin, β-amyrin acetate, taraxerone, campesterol, euphoserol (*C_{25}H_{36}OH*), phytosterolin, stigma sterol, euphorbol hexacosanoate, kaempferol, leucocyanidol 12-deoxy - 4β-hydroxyphorbol - 13-dodecanoate - 20-acetate, 12 deoxy - 4β-hydroxyphorbol - 13-phenyl acetate - 20-acetate, quercitol, afzelin, myricetin, myricitrin, quercitin and its 7-glucoside and rhamnoside, quercetin, rutin, xanthorhamnin, ingeniol triacetate, 1 inositol, myoinositol, 1-hexacosanol, n-octacosanol and triacontane, amino acids, choline chlorophenolic, gallic, glyoxalic, pyruvic and shikimic acids, linoleic, melissic, oleic, palmitic and protocatechuic acids, tannin and related polyphenols, tinyatoxin (Chatterjee & et.al, 1997).

Three new dimeric hydrolyzable tannins- euphorbins C,D and E-isolated and their structures determined. Gallic acid quercetin, myricitrin, 3,4 di-O-galloylquinic acid, 2,4,6-tri-O-galloyl-β-O-glucose and 1,2,3,6-penta-O-galloyl-β-D-glucose isolated from leaves. (Rastogi et.al -1990-94)


In *E. thymifolia* whole plant contains taraxerol, epitaraxerol,


Essential oil present. Leaves and stems contain 5, 7, 4 - trihydroxy flavone 7 - glycosides.

In *Phyllanthus reticulatus* leaves contain β - sitosterol and friedelin ( also in stem), friedelan - 3β-ol, glochidonol 21α - hydroxy friedelan - 3 - one, 21α - hydroxyfriedel -4, (23) - en - 3- one and betulinic acid; betulin, glochidonol, friedelin, epi-friedelinol, 21α - hydroxyfriedelan - 3- one, octacosanol, taraxeryl acetate, taraxerone and β- sitosterol are obtained from root (Chatterjee and Pakrashi 1997).

Accumulation of aluminium noted by Chenery (1950) in Commelinaceae steroidal saponins are noted in only one genus of Commelinaceae - *Cyanotis*. C - glycoflavones are reported by Martinez (1981). Flavonols and tannins scattered in the family. Two distinct patterns of anthocyanins have been found in the family (Stirton and Harborne 1980).