CHAPTER I

INTRODUCTION
Investigations and development of plant chemistry is an outcome of the old proverb, "Necessity is the mother of invention". Man has sought to use plants\textsuperscript{1} as resources for nourishment, defence and protection from diseases\textsuperscript{2} from times immemorial. Several authors\textsuperscript{3-9} have described the importance of Indian Medicinal Plants.

The ancient man used the raw extracts of the plants for the amelioration of human sufferings without knowing their chemical constituents. With the growth of civilisation the plants have been thoroughly investigated throughout the ages and their importance understood either for beauty or utility. By trial and error, he identified several plants possessing medicinal properties. These informations have been passed on from generation to generation.

The earliest mention of the medicinal use of plants\textsuperscript{10} is found in Ebers papyrus (1600 BC). More than 700 herbal remedies are described in it. The progress in the study of medicinal plants is closely connected with the essential needs of life. The Scholar Emperor 'Shum-Nung' (2735 BC) compiled a book of herbs. He was the first to observe the
antifebrile effect of Chang-Shan which has been shown to be due to the antimalarial alkaloids$^{11}$ of more or less same potency as quinine. One great herbal drug of the 17th century which has survived the test of time is 'cinchona bark'. In years that followed the Aryans in India have brought out Ayurveda, Susruta-Samhita and Charaka-Samhita, which contain properties and therapeutic uses of many drugs$^{12}$. 'Ayurveda' which is supplement to "Vedas" records definite properties of drugs and their uses in some details.

RECENT TRENDS OF WORK

It has been generally accepted that the conservation of gene pools of medicinal plants is urgently needed$^{13}$. For quite a time a number of scientists have been working for the proper identification of medicinal herbs pin pointing the chemical constituents in the various parts of the plant, investigating the pharmacological, anti-microbial$^{14,17}$ and anthelmintic activity$^{18,19}$ and toxicity of compounds isolated from them. The effect of volatile oils fixed oils and different extracts of the plant in destroying or inactivating microorganisms has also received considerable attention.

The compounds isolated from various plants have been investigated one after another and their structures elucidated.
An important plant possessing medicinal properties is *Rauwolfia serpentina*\(^{20-21}\) which has been used for centuries in indigenous medicine in India "for all the ills of man".

Cancer is a disease which takes a toll of about two lacks of people every year. Many researchers have been busy to find out plant sources which can be used as anti-cancer drugs\(^{22-24}\). The ethanolic extract of the leaves and stems of *Annona squamosa*\(^{25}\) has been reported to have anti-cancer activity\(^{26}\). The bitter constituents of *Centella asiatica* (Thakkuni) have been found to be much efficacious in amoebic dysentery. It has also been found useful in syphilitic skin diseases. Its leaves have been used as brain tonic. Dutta and Basu have reported a glycoside\(^{27}\) useful as an oral antifertility agent. Recently two new flavonolignans have been isolated from the seed oil of *Hydnocarpus vigthiana* (Blume), which has been used as a remedy for treatment of Leprosy\(^{28}\). *Actinodaphne* syn. *A. hookeri*, rich in alkaloids has been found useful in the treatment of urinary disorders and diabetes\(^{29}\).

Munshi *et al.*\(^{30}\) and Kholkute *et al.*\(^{31}\) have shown the possibility of obtaining antifertility agents from plants. Recently an Ayurvedic drug, a phytoproduct of *Mammalia quadrifolia* has been isolated and synthesised by R.R.I. Calcutta to cure the mentally handicapped\(^{32}\). Different parts of *Alstonia venenata* R.Br. have been used in the
treatment of insanity and epilepsy\textsuperscript{33}. The roots of *Amaranthus spinosus* Linn. have been reported to be used in menorrhagia, gonorrhea, eczema and colic\textsuperscript{34}. The bark of *Diospyros montana* Roxb. has been investigated to establish antitumour activity\textsuperscript{35}.

**CHEMISTRY OF PLANT PRODUCTS**

The tremendous advancement in the field of medicine and the quest for new structural type of compounds, stimulated the investigation and revaluation of the age old medicinal herbs and plants. The curative value of the plants has been ascribed to the presence of certain active chemical principles, which fall into the following group of compounds: (i) essential oils (ii) fixed oils (iii) glycosides (iv) alkaloids (v) terpenoids (vi) steroids (vii) flavonoids (viii) proteins (ix) carbohydrates (x) coumarins (xi) colouring matters (xii) enzymes etc. These group of compounds have been used from the dawn of civilisation for various medicinal purposes, but their chemical nature has been understood only in recent years with the help of modern techniques, which have immense utility in elucidating the structure of new compounds as well as in synthesising them.

Some of the important compounds which have been investigated by the author, have been reviewed briefly
as follows:

**Essential Oils**:  
The main constituents of essential oils are terpenic hydrocarbons and their oxygenated derivatives. In recent years essential oils have been extensively used to destroy microorganisms.

The occurrence, importance, chemistry and biosynthesis of essential oils have been reviewed in standard works\textsuperscript{37-51}. Recent investigations of some scientists in this field are also quite interesting.

**Fixed Oils**:  
The occurrence, significance, importance and the chemistry of fixed oils are reviewed in standard works\textsuperscript{54-65}.

**Natural Glycosides**:  
Natural glycosides can be divided into two classes (1) glycosides and (2) saponins.

Glycosides\textsuperscript{66-75} are distributed in different parts of plants. The significance of glycosides is not known much at present but it is assumed that these act as a defence to protect the plants from the destruction of animals and as storage deposits of sugars for quick release at the time of development. As glycosides are built up of
hydroxy compounds and sugar parts, acid hydrolysis breaks them into non-carbohydrate part called 'aglycone' and sugar part. The linkage of aglycone with the sugar unit may be with nitrogen, oxygen, sulphur or even with carbon. Many glycosides have been attributed with therapeutic action and used as drugs.

**Saponins**:

The term saponin is applied to the group of plant products which produce soapy lather when they come in contact with aqueous solution and haemolyse the blood. Therefore, saponin bearing plants have been used as fish poisons. Glycosides having steroidal and tri-terpenoidal nature are mostly saponins. On hydrolysis saponins yield one or more sugar units and an aglycone called sapogenin. Recent investigations of saponins have been reviewed in standard works 76-84.

**Protein**:

No form of life can exist without proteins. Proteins are the building materials for living organisms. They are complex compounds. Studies in this field has been reviewed 85-91 extensively.

**Carbohydrates**:

Carbohydrates provide basic needs of life. They form
important structural materials for plants and occur in all living cells. The main function of carbohydrates is to supply energy. Chemistry of carbohydrates has been reviewed in well known works $^{92-96}$.

**MODERN TECHNIQUES OF RESEARCH**

In modern era introduction of new techniques has facilitated the progress in the study of medicinal plants. These methods include chromatography (various types), spectroscopy (u.v., i.r. and n.m.r.) and mass spectrometry. The advent of these methods have given stimulus to the phytochemist and have made his task easier and more accurate. The techniques are quite well known and reviewed in standard works as below : chromatography $^{97-103}$, u.v. $^{104-106}$, i.r. $^{107-111}$, n.m.r. $^{112-116}$ and mass spectrometry $^{117-122}$.

**PROBLEM TAKEN AND WORK DONE :**

Phytochemistry is a dynamic science and much of the fascination of the subject is due to ever increasing utility of its developments for humanity at large. Each time some new ideas are discovered or an old idea amended, there is a profound impact on human life. This has encouraged the scientists to work with zeal and confidence on new lines of investigations.
A knowledge of biological activity and chemical constituents of plants is desirable as this may lead to the discovery of new therapeutically active agents and new sources of economically useful materials. It may also lead to the isolation of compounds which may not be of any intrinsic value in themselves but may have a novel chemical structure. This is likely to stimulate the scientist to investigate the hitherto unworked plants.

Investigations on antimicrobial screening of different plant products like essential oils, fixed oils, saponins and different successive extracts have given very interesting and encouraging results in the past and thus paved the way for researchers to produce synthetic drugs of ever increasing potency.

The author has been influenced in selecting the topic based on the plant kingdom with a view to explore the chemical constituents of hitherto unworked or less worked medicinal plants, by employing modern physico-chemical techniques. The present findings have been summarised briefly as follows:

1. Studies on Saponin and Sapogenin from the Leaves of *A. aspera* Linn.:

A new saponin has been isolated from the alcoholic extract of the leaves of *A. aspera* Linn. and its structure
has been elucidated as olean \( \Delta^{12} \) ene-28 oic-3-o-\( \alpha-L \)-rhamnopyranosyl \( (1 \rightarrow 4) - \beta-D \)-galactopyranosyl \( (1 \rightarrow 4) - \beta-D \)-glucopyranoside] with the help of chemical and spectroscopic studies.

2. Chemical Examination of the Essential Oil derived from the Flowers of *A. odoratissimus* R.Br

A yellowish white mobile essential oil with a characteristic smell has been isolated from the flowers of *A. odoratissimus* in an yield of 0.22% by the steam and water distillation method. Investigations on the oil have shown the presence of the following compounds: caryophyllene oxide (40.01%), \( \beta \)-caryophyllene (16.88%), dl-\( \alpha \)-pinene (14.38%), d-linalool (12.45%), farnesol (10.05%), \( \alpha \)-terpineol (3.05%), geraniol (1.03%), methylheptanone (0.36%), d-citronellol (0.35%) \( \Delta^{3} \) carene (0.16%) and p-cymene (0.12%). Geranyl acetate, 1:8 cineole, 1-borneol and two unidentified compounds have been found in traces, out of which the former three have been confirmed by \( \gamma \)-GLC only.

3. Studies on the Fixed Oil from the Fruits (with seeds) of *A. odoratissimus* R.Br.

The bright yellow fixed oil has been extracted from the fruits of *A. odoratissimus* R.Br. in an yield of (2.85%). It has been found to be a mixture of the glycerides of
palmitic (17.15%), stearic (6.45%), arachidic (1.90%), oleic (59.03%), linoleic acid (12.40%) and linolenic (3.07%) acid.
and The unsaponifiable matter of the oil consists of β-smyrin, β-sitosterol, lupeol and an unidentified hydrocarbon.


Proteins have been isolated from the fruits of A. odoratissimus (yield 1.95%) and the leaves of A. aspera (yield 10%). The protein hydrolysates of both the plants contain respectively: - alanine (-, 9%), arginine (2.5%, 1.9%), aspartic acid (9.5%, 12.2%), cystine (14%, 6.8%), glutamic acid (6%, 11.5%), glycine (13%, -), histidine (5%, 4.3%), hydroxy proline (16.1%, 9.4%), leucine/isoleucine (8.4%, 13.6%), lysine (3.5%, 3.5%), methionine (6.2%, 2.1%), phenylalanine (-, 6%), proline (-, 10%), threonine (7.6%, 1.95%), tryptophane (5%, 1.0%) and valine (-, 5.2%).

The carbohydrate part showed the presence of D-arabinose, D-fructose, D-galactose, D-glucose and sucrose in the fruits of A. odoratissimus R.Br. and D-galactose, D-glucose, L-rhamnose and D-xylose in the leaves of A. aspera Linn.

5. Antimicrobial Screening of Different Plant products:

PART - A:

Three essential oils, isolated from the flowers of
Artabotrys odoratissimus R.Br. leaves of Anisomeles indica Linn. (Syn. A. ovata) and leaves of Anisochilus carnosus Wall one fixed oil and the methyl esters of mixed fatty acids from the fruits (with seeds) of A. odoratissimus R.Br. have been screened for antimicrobial activity against the following human and plant pathogenic bacteria and fungi using filter paper disc diffusion method:-


The essential oil and fixed oil of A. odoratissimus has been found active against most of the organisms and hence can be utilised as bactericidal and fungicidal agent.

PART - B :

The in vitro antibacterial and antifungal activity of various successive extractives of the leaves of A. aspera Linn. has been determined against the above stated bacteria and fungi with encouraging results so as to make these useful therapeutically.
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