SECTION 1

INTRODUCTION, DISCUSSION
AND
EXPERIMENTAL
TO /
PROXIMATE ANALYSIS
OF SOME MEDICINAL PLANTS
Since disease, decay and death have always co-existed with life, the study of diseases and their treatment must also have been contemporaneous with the dawn of human intellect. The ancient civilization of India had also a glorious history of materia medica which has been a source of many remedies even to the present day. Plants have been used by man since prehistoric days for relieving sufferings and curing illness. The history of medicine in India can be traced to the remote past. The earliest recorded mention of the medicinal use of plants is found in the 'Rigveda', which is one of the oldest repositories of human knowledge and is believed to have been written between 4500 and 1600 B.C., and where in mention has been made of the 'Soma' plant and its effects on man. In a later production, the Atharvaveda, the use of the drug is more varied. It is in the Ayurveda, which is considered as an Upveda, that is definite properties of drugs and their uses of the ancient medical science of India are mentioned. Ayurveda, is the very foundation stone of the ancient medical science of India. Ayurveda, which deal with different aspects of the science of the life and the art of
healing. The age of Ayurveda is fixed about 2500 to 600 B.C. Susruta Samhita which was written not later than 1000 B.C. contains a comprehensive chapter on therapeutics and Charaka Samhita, written about the same period, gives a remarkable description of the materia medica as it was known to ancient Hindus. 'Bhoja-prabandha', a treatise written about A.D. 980 contains a reference to inhalation of medicaments before surgical operations and an anaesthetic called 'Sammohini' is said to have been used in the time of Buddha.

Later, during the Buddhist period, considerable progress was made and medicinal plants were cultivated under the direction of highly qualified specialists. The influence of Hindu medicine permeated far and wide into Egypt, Greece and Rome, and moulded the Greek and Roman medicine through the former, Arabic medicine also. During this period, Indian medicine was at its zenith and the knowledge of the Hindu physicians in the domain of drug therapy and toxicology was far in advance of others. With the advent of the muslim conquerors, the decline was even more rapid. The muslims brought their own healing system, which was fairly advanced for that period. The Arabic system thus introduced, became the system of relief and brought with it a rich store of its own materia medica.
The Egyptians in 1500 B.C. or even 3000 B.C., were not the first people to exhibit an active concern about the plants. Over 6000 years ago, the ancient Chinese were using drug plants as were the Egyptians, Sumerians and senites, long before there were any physicians in the modern world. European medicines may be said to have been founded by Hippocrates in the 4th century B.C.

In the 17th century, Vesalus had revolutionised anatomy and para-modern surgery. In the 18th, Bizarre medicaments gave way to more important medicaments.

The first half of the 19th century saw the progress of Chemistry of phenomenal pace. In the second half of the 19th century, pharmacology became truly scientific. Many new drug including plants, minerals and biological products had more been submitted to scientific screening before being incorporated in therapeutics.

During the centuries that have gone by, the materia medica of the indigenous systems of medicine has become extensive and heterogeneous. Out of about 2000 items recorded in Indian medicinal literature, less than 200 are of mineral and animal origin; the rest are derived from vegetable sources. The vegetable materia medica has been built up in the course of centuries and every region of India has
contributed to its development. The practitioners of various Indian systems in different parts of India tried to utilise the locally growing plants as far as possible and accepted those which were found useful after trial for treatment of diseases.

Materia Medica was enormously investigated and studied on the basis of "Panchabhautika" and "Tri Dosha Siddhantas". The effects of the five inherent properties of every substance viz. Rasa, Guna (property), Veerya (heating and cooling effects), Vipaka (remote action after assimilation) and Prabhava (specific action) on health and disease were explained. All substances were classified under different classes according to the nature of such origin as Mineral, Vegetable and Animal, and also according to their properties and actions as Deepana (carminative), Pachana (digestive) etc. Each drug was given different names (synonyms) indicating its medicinal properties, actions, botanical descriptions, habitants, etc.

Hindu sciences teach that plants have a sort of dormant or latent consciousness and care capable of feeling pleasure and pain. In Santiparva of Mahabharatha we find references to the sensitiveness of plants to heat, cold, to the sound of thunder, etc., as well as to odours both pleasant and
unpleasant. Charaka divides plants into four classes, viz. Vanaspities (trees bearing fruits without flowers); Vanaspatyas (trees bearing both fruits and flowers); Oushadhees (herbs that whither after fructification) and Virrudhas (other herbs with spreading stems).

In order to understand Ayurveda, one must first learn the meaning of the terminology and the language used in Ayurveda. The approach of Ayurveda to man is quite different. The spiritual outlook is very important.

If the modern scientists cannot understand some of the Ayurvedic theories, it is because of the limitations of modern science. As and when science advances, the Ayurvedic lore becomes more and more understandable. To use my super science, which means that it is a welcome combination of philosophy and science. Further Scientific Research will prove this one day, because truth must always prevail.¹-³

The indigenous system of medicine, Ayurveda is still one of the most important and applicable system of medicine. Ayurveda system of medicine is still applied amongst a great percentage of population throughout India. Ayurveda aims to preserving and promoting health as well as preventing and curing disease. The preservative and preventive aspects have list their individuality due to varied reasons and have got
mixed up with other culture, religion and tradition.

Ayurveda aims at treating the patient as a whole. In India system of medicine, a number of herbal drugs have been used by the human being for the treatment of various diseases and complaints. These indigenous drugs have been proved useful for the welfare of human society, and employs drugs of low toxicity or non-toxic, taken in comparatively large doses and mainly orally. The drugs do not produce a quick symptomatic effect, but work slowly and very often officaniously to increase the patients natural resistance and recuperative power.

The indigenous system of medicine practised in India is based mainly on the use of plants, and there exists a rich literature on the subject. Ancient medicine was not solely based on empiricism and this will be evident from the fact that some of the medicinal plants, which were used in ancient days, have still their place in modern therapy. Thus for examples, Ephedra a plant used in China 9,000 years ago is still mentioned in modern pharmacopoeias as the source of an important drug ephedrine. The plant Sarlagandha (Rauwolfia Serpentina) which was well known in India as a remedy for insanity has now shown that one of its constituents, reserpine, is a wonder drug of today for curing mental
ailments. 'Quinine' another important antimalarial drug of present day, was obtained from the Cinchona bark.

Early European workers in this country took keen interest in this group of plants and a lot of work has been done by them. During the last 150 years, although a good deal of work, was done on the botanical unit to take up an exhaustive survey of medicinal plants.

At present some of the institutions in India are actively engaged in conducting researches on several plants of medicinal value and a great deal of data is being regularly accumulated. The PID (Publications and Information Directorate) of the Council of Scientific and Industrial Research is presently furnishing latest computerised information on medicinal plants to various researches in the country.

In present work, the following eight medicinal plants are to be analysed for their chemical composition, such as moisture, fat, ash, carbohydrates, proteins, starch and fibre, alkaloids, etc.
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<th>NO.</th>
<th>BOTANICAL NAME</th>
<th>ENGLISH NAME</th>
<th>SELECTED PART</th>
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<td>1</td>
<td>Alhagi camelorum Fisch</td>
<td>Camel thorn</td>
<td>Stem</td>
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<td>2</td>
<td>Crataeva religiosa Hook</td>
<td>Three leaved caper</td>
<td>Bark</td>
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<td>3</td>
<td>Asparagus racemosus Willd</td>
<td>Wild asparagus</td>
<td>Root</td>
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<td>4</td>
<td>Swertia chirata Ham Willd</td>
<td>Chiretta</td>
<td>Whole plant</td>
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<td>5</td>
<td>Vernonia anthelmintica Willd</td>
<td>Purple flea bane</td>
<td>Fruit</td>
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<td>6</td>
<td>Holarrhena antidysenterica Willd</td>
<td>Easter tree or Ivory tree</td>
<td>Bark</td>
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<td>7</td>
<td>Piper nigrum Linn</td>
<td>White pepper</td>
<td>Fruit</td>
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<td>8</td>
<td>Vitex negundo Linn</td>
<td>Five leaved chaste tree</td>
<td>Leaves</td>
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A number of medicinal properties are described to the selected medicinal plants or plant parts. A brief account of morphology, distribution, description, chemical constitution and medicinal uses of these selected medicinal plants is given below. 4-10

1. *Alhagi camelorum Fisch* (*camel thorn*):

*Alhagi camelorum* Fisch belongs to the family **leguminosae**.

A low erect shrub, armed with copious hard sharp spines reaching sometimes 1-5 inch long branches terete, striate, glabrous or nearly so. Leaves simple, coriaceous 1/4-3/8 by 1/8-3/14 in. obovate, oblong, obtuse, apiculate, glabrous or puberulous, base cuneate, petioles very short, slender, calyx glabrous 1/6 in. long, teeth short triangular. Corolla a little more than twice as long as the calyx; standard 1/3 in. long by 1/5 in. broad obovate, oblong, auricled at the base above the claw, glabrous, ovary glabrous. Pods 3/4-5/4 in. long, usually falcate more or less contracted between the seeds. Glabrous seeds blackish-brown, smooth polished Boiss.

This genus of thorny shrubs comprises about 3 species, distributed in India, North and North-West provinces, Baluchistan, Egypt and Arabia.
The sugary secretion obtained from this plant is said to be collected in Persia and exported to India.

The plant is bitter and acrid with a distinct flavour; refrigerant, digestible, antipyretic, tonic, laxative, diuretic, removes excess of fat, cures brain affections, leprosy, skin diseases, bronchitis; allays thirst and improves appetite useful in epistaxis.

The plant has a bitter bad taste; alexeteric, maturant, aperient attenuate good for piles, opacities of the cornea and hermicrania. An oil from the leaves is used for rheumatism. The flowers are good for piles. The manna is aperient, cholagogue, expectorant diuretic, fattening, aphrodisiac, purifies the blood, good in vomiting, small pox eruptions, asthma and piles. It has a slightly bad taste.

The infusion has a diaphoretic action. The decoction of the root is made and used externally for swellings abscesses and put into the water for bathing.
Crataeva religiosa Hook (Three leaved caper):  

Crataeva religiosa Hook belongs to the family capparidaceae.

A moderate-sized deciduous tree, leaves trifoliate, often clustered towards the ends of the branches, long petioled leaflets ovate, acuminate, glabrous shining above pale beneath, 2-5 by 0.75-1.5 in. petioles 2 in. long; petiolules 25 in. long, articulate flowers 2 in. across, on filiform pedicels. Sepals 2 in. long petaloid ovate deciduous petals much larger than the sepals with the claw 0.75-1 in. long. Limb ovate or oblong, veined. Filaments purple, longer than the petals inserted above the disk on the base of the filiform, 1.5 in. long gynophore, ovary 2-ribbed ovoid; stigma sessile discoid, Berry ovoid, woody, scurfy, 1.2-2 in. in diameter, many seeded. Stalk stout 1.5-4 in. long Seeds 0.25 in. long reniform, immersed in yellow pulp usually cultivated in the vicinity of temples in central India, Bengal and Assam, and also found in Malabar and Kanara.

Bark, leaves and root-bark are mostly used as medicines. Leaves are stomachic and tonic; leaves of C.Roxburghii are very good counter-irritant; root and the bark are laxative and lithoutriptic, the root is also alterative. Root and bark promote appetite, increases biliary secretion, fresh leaves
are externally rubefacient and internally febrifuge and tonic. Leaf juices in doses of 1 to 3 tolas is given in rheumatism mixed with coconut milk and ghee. Externally the bark and leaves pounded and tied in a cloth are applied as a fomentation root and the bark are also used in the form of embrocation which is prepared by boiling them in oil. They form the principal medicine for calculas affections. Bark is specially useful in urinary complaints such as kidney and bladder stones, fevers and to relieve vomiting and symptoms of gastric irritation. It is generally administered in the form of decoction with the addition of treacle; the decoction is prepared by bruising and boiling 4 ounces of the bark in 1.5 pints of water till reduced to 1 pint and then strained and cooled; the dose is about 2 ounces two or three times daily as a good anti periodic and tonic. Bark is also used in snake bite. The infusion of leaves is described as a bitter and aromatic tonic and given in doses of 2 to 4 ounces thrice daily. Compound decoction containing its roots, bark and leaves and small caltrops ginger, carbonate of potash, honey and water is very useful in ascites, urinary disorders and in calculous affection. A confection called Varunadya guda is prepared by adding to the fluid extract of the bark, treacle and a number of diuretic and aromatic substances.
3. *Asparagus racemosus* Willd (Wild asparagus):

*Asparagus racemosus* Willd belongs to the family Liliaceae.

A tall climbing under shrub with annual woody terete stems. Branchlets triquetrous, spines 5-13 mm. long recurved or rarely straight. Cladodes 1.3-2.5 cm. long in tufts of 2-6 curved. Flowers white fragrant, in solitary or fascicled, simple or branched racemes 2.5-5.0 cm. long. Pedicels 5 mm. long, jointed in the middle perianth about 3 mm. long, stamens as long as the perianth Berry 5-8 mm. in diameter.

This climber growing in low jungles is found all over India especially in Northern India in Himalayas from Kashmir eastwards. In tropical Africa, Java and Australia.

Roots and leaves are mainly used as medicine. The roots are bitter sweet, aphrodisiac, laxative, expectorant galactagogue, tonic, useful in diseases of the kidney and the liver scalding urine, gleet, gonorrhoea. The root of this plant is used medicinally as a refrigerant demulcent, diuretic, aphrodisiac, antispasmodic, alterative, antidiarrhoeatic and antidysenteric. It is used chiefly as a demulcent in veterinary medicine. A decoction of the tubers was administered as a stomachic tonic in a tonic dyspepsia but the action was found to be slow and the result not
encouraging.

4. **Swertia chirata Ham (chiretta):**

Swertia chirata Ham belongs to the family Gentianaceae. Annual or perennial erect herbs. Stem 2-5 feet, 4 laneolate or subterete. Leaves 1.5 in. prominent sometimes peltioted. Panicles large, leafy, many-fid; pedicels nil- 0.75 in.; foscicled mostly short. Calyx lobes 0.15 in., lanceolate corolla-lobes 0.25 in., ovate accumulate more or less purplenerved, the glandular depressions are green, shallow, often submarginal rarely close together or sub-confluent with a fringe of long white or pink hairs at the summit. Filaments linear, free anthers oblong; style cylindric; stigmas oblong. Capsule 0.25 in. and upwards, ovate acute seeds 0.02 in., polyhedral, smooth, testa close, not reticulated. Flowering in early cold weather and fruiting later.

Stems robust, 0.6-1.5 in.; branching terete except near the top. Leaves broadly lanceolate, 10 by 3.8 cm., acute calyx and corolla 4 lobed. Corolla green yellow, tinged with purple; two glands on each lobe, green fringed with long hairs.

It is found in temperate Himalayas at altitudes above 4000 feet from Kashmir, Simla to Nepal and Bhutan, Khasia
Range and sometimes found in various other parts of India.

The plant is bitter; cooling anthelmintic, antipyretic, antiperiodic, laxative, galacta, gouge, cures thirst, biliousness, leucoderma, inflammations, burning sensations, pain in the body, urinary discharges, ulcers, piles, bad taste in the mouth and for vomiting in pregnancy.

The plant is bitter with a sharp taste; astringent, tonic, stomachic; lessens inflammation improves eye sight; sedative to pregnant uterus; good for pain in the joints, scabies, leucoderma, skin diseases, chronic fevers.

5. **Vernonia anthelmintica Willd (Purple flea bane):**

Vernonia anthelmintica Willd belongs to the family compositae.

A coarse robust herb 4-6 feet high, stems striate, often blotched with purple. Leaves 3-6 in. long by 1-2 in. broad, Lancoelate or ovate-lanceolate, long pointed harrowed into a short stalk coarsely serrate membranous rather rough. Heads 0.5-0.75 in. diameter many flowered a stout peduncles 0.5-2 in. long, of ten sub-corymbose. Involucralbracts, linear, tips, dilated, coloured outer ones longer than the inner Acheres 0.2 in. long narrowed towards the base, black ribbed and hairy pappus reddish with an outer raw of short rigid
persistent chaffy scales.

Annual, robust, erect, leafy, stems 60-90 cm. high, branched, pubescent. Leaves 5-9 by 2.5-3.2 cm. lanceolate or elliptic lanceolate, acute, coarsely serrate, more or less pubescent on both sides, base tapering into the petiole. Heads 1.3-2.0 cm. diameter, subcorymbose many (about 40) flowered, with a linear bract near the top of the peduncle—outer involucral bracts linear, hairy, herbaceous, shorter than those of the inner rows; intermediate bracts with herbaceous hairy tips, linear rows; intermediate bracts with herbaceous hairy tips, linear, acute or subobtuse, often constricted at the base of the herbaceous part, equalling or shorter than the innermost, innermost bracts usually the longest, linear, subacute, scarious often tipped with purple. Pappus reddish, the exterior raw very short, subpaleaceous, persistent the inner hairs some what flattened, deciduous, much shorter than the glabrous corollas. Achenes 4.5-6.0 mm. long oblong-cylindric 10 ribbed pubescent.

This plant is common in waste places near villages throughout India.

The seeds have a sharp bitter taste, anthelmintic, and are also an ingredient of a compound powder prescribed in snake-bite. The seeds are also used in tonic, stomachic,
antiperiodic, round worms and diuretic. It is used in decoctions to promote perspiration in fevers.

6. **Holarrhena antidysenterica** Wall (Easter tree or Ivory tree):

Holarrhena antidysenterica Wall belongs to the family Apocynaceae.

A shrub or small tree, glabrous or pubescent, bark pale. Leaves 10-20 by 5.0-11.5 cm., from broadly ovate to elliptic, obtuse or obtusely acuminate, glabrous or more or less pubescent, base usually obtuse; main nerves 10-14 pairs, conspicuous petioles 3 mm. long sometimes. Flowers white inodorous in terminal corymbose cymes 7.5-15.0 cm. diameter; pedicles slender; bracts small, lanceolate, pubescent and ciliate. Calyx-lobes 2.5-3.0 mm. long, oblong-lanceolate, acute, ciliate corolla-puberulous outside; tube 8-13 mm. long slightly inflated near the base over the stamens. mouth not closed with a ring of hairs, throat hairy inside; lobes about equalling the tube, oblong, rounded at the apex more or less pubescent. Follicles 20-38 cm. long, 6-8 mm. diameter, cylindric often dotted with white spots. Seeds 8 mm. long or rather more, linear oblong, tipped with a spreading deciduous coma of brown hairs 2.0-2.5 cm. long.
It is found more or less throughout India, ascending to an altitude of 4,000 feet in the Western Himalayas. Also found in Malay Peninsula.

The bark is bitter, dry, pungent, heating, acrid, anthelmintic, dysentery, diarrhoeas, fevers, piles, leprosy, "Kapha", thirst, skin diseases and diseases of spleen. The stem and root barks are medicinal and have long been used in India in the treatment of dysentery under the name of Kurchi the stem bark. It consists of dried bark collected from 8-12 year old plants and freed from attached wood; it is available in small pieces. The bark has astringent, antidysentric, anthelmintic, stomachic, febrifugal and tonic properties. It is used in the treatment of amoebic dysentery and diarrhoea and is usually administered as extract or decoction. Although slow in action as compared with emetine, it is less toxic and can be administered orally.
7. **Piper nigrum Linn (White pepper):**

Piper nigrum Linn belongs to the family Piperaceae.

A Stout glabrous climber, stems terete, sparingly rooting much thickened at the nodes. Leaves coriaceous, 10-18 by 5.0-12.5 cm., broadly ovate, acuminate glabrous, 5-9 newed, the supra basal nerves usually alternate base usually rounded, more or less oblique; petioles 1.3-2.5 cm. long. Flowers in slightly interrupted glabrous spikes of variable length (5-15 cm.), dioecious or sometimes polygamous, bracts of the female spikes more or less adnate to the rhachis, forming a short hemispheric cup beneath the ovary; bracteoles forming a semilunar ridge above the ovary. Stamens 2, stigmas 2-4, Fruit globose, 6 mm. diameter or less at first yellow, afterwards becoming red when fully ripe.

**Preparation and General Characters of White pepper:**

White peppers is prepared from the fruits of the black pepper plant. The process varies somewhat in different districts, but the spikes of ripe fruit are commonly left for two or three days after being gathered, they are then washed and bruished with the hand in a basket or some other suitable receptacle, till all the stalks and the soft dark outer layer
of the pericarp are removed and are finally dried. Hence white pepper is the fruit deprived of the greater portion of the pericarp in fact is but little more than the seed. These grains as the prepared fruits are then commonly called are some what larger than black pepper, smooth, nearly round and of a greyish or yellowish-white colour. They are hard and horny externally and mealy within their taste and odour are similar to but less marked than black pepper.

The Black pepper is found from Malabar to Travancore coast of India.

The fruit has a sharp, pungent slightly bitter taste, carminative, bechic, aphrodisiac, purgative, alexipharmic useful in toothache, inflammation, pain in the liver and the muscles, diseases of the spleen, eructations, leucoderma, lumbago, chronic fevers, paralysis and in menstruation it is widely applied.

Pepper is much employed as an aromatic stimulant in cholera weakness, following fevers, vertigo coma as a stomachic in dyspepsia and flatulence; as an antiperiodic in malarial fever and as an alterative in paraplegia and arthritic diseases. In China it is considered an energetic, stimulant, diaphoretic and carminative. It is used as a care for dysentery in Cambodia.
8. *Vitex negundo* Linn (*Five leaved chaste tree*):

*Vitex negundo* Linn belongs to the family *Verbenaceae*.

A large shrub or sometimes a small slender tree; bark thin, grey branchlets quadrangular, whitish with a fine tomentum. Leaves 3-5 foliolate; leaflets lanceolate, acute, the terminal leaflet 5-10 by 1.6-3.2 cm. with a petiolule 1.0-1.3 cm. long, the lateral leaflets smaller with a very short petiolule, all nearly glabrous above, covered with a fine white tomentum beneath, base acute; common petioles 2.5-3.8 cm. long. Flowers in pedunculate branched tomentose cymes, opposite along the quadrangular tomentose rhachis of a large terminal often compound pyramidal panicle (axillary peduncles in the upper axils sometimes present); bracts 1.5-2.5 mm. long, lanceolate caducous. Calyx 3 mm. long, white tomentose; teeth triangular 0.8-1.0 mm. long. Corolla 1 cm. long bluish purple, tomentose outside hairy inside at the insertion of the stamens; upper lip 2 mm. long, divided to the base into 2 obtuse lobes, lower lip large, 5 mm. long with 2 short oblong obtuse lateral lobes 1.5 mm. deep, and a large broadly obovate crennlate terminal lobe 4 mm. long. Filaments hairy at the very base. Ovary glabrous; stigma forked Drupeless than 6 mm. diameter black when ripe.

It is found throughout India, Ceylon, Afghanistan,
tropical Africa, Madagascar, China, Philippines.

The plant has a pungent, bitter, acrid taste, heating astringent, cephalic, stomachic anthelmintic, promotes the growth of hair, useful in diseases of the eye, consumption, inflammations, leucoderma, enlargement of the spleen, bronchitis, asthma, biliousness, painful teething of children. The leaves are aromatic, tonic and vernifuge. A decoction of nirgundi leaves is given with the addition of long pepper in catarrhal fever with heaviness of head and dullness of hearing. The leaves are discutient and are useful in dispersing swellings of joints from acute-rheumatism and of the testes from suppressed gonorrhoea. The dried leaves are smoked for the relief of headache and catarrh. The juice of fresh leaves is poured into the nostrils in stuper and coma, and is given internally.

**CHEMICAL CONSTITUTION:**

As dry samples of the medicinal plants were selected, the moisture content was determined on dry basis. It is present in varying amounts in medicinal plants. The determination of proteins along with nitrogenous substances such as amino acids and alkaloids. The fat is not merely a mixture of glycerides, but contains sterol, lecithine and
other substances of similar solubility; the fibre is partly cellulose and partly lignified or suberized substances; the ash is a mixture of common inorganic elements and may contain traces of an indefinite number of rare elements, disclosed by exacting chemical and spectroscopic methods; and finally the nitrogen free extract represents, in addition to the carbohydrates other than cellulose, and organic acids, the resultant of all the errors of the determination of all the other constitutions.

**MOISTURE:**

Food and food products may contain water in different forms. The most common form is free or absorbed water. Many products also contains absorbed or bound water. Water of crystallisation and mechanically concluded water may also be present in some materials.

In cereals, dry legumes, flour and meal the amount of water usually ranges from 10-15%. In the edible portions of succulent fruits and vegetables it may reach 95% but in starchy vegetables, such as potatoes and fresh shelled beans, it is commonly only 70 to 80%. Milk contains an average of 87%, lean meat and fish muscle 50 to 70%, and opened oysters 70 to 90% on fresh basis.
Most of the methods for the estimation of water in food depends on the loss in weight on heating. Some of the most widely used methods are: Oven drying method,\textsuperscript{11} Hydrogen drying method,\textsuperscript{12} Spencer vacuum drying method,\textsuperscript{13} Toluene distillation method,\textsuperscript{14} Fischer titration method,\textsuperscript{15-16} Nuclear magnetic resonance method,\textsuperscript{17} Gas liquid chromatography,\textsuperscript{18} and Infrared absorption method.\textsuperscript{19}

**FAT:**

Fats and fatty oils are widely distributed in the vegetable and plant kingdom occurring both in the vegetable and reproductive structures, it being highly probable that all living cells contain a certain amount of fatty material. The chief is the seed, leaf, bark, root, petals and stemens contain fat only to limited extent.\textsuperscript{20}

Kernels of nuts, such as almonds, walnuts and Brazil nuts contain as high as 70% of fat. The soyabean, a starchfree legume contains up to 20%, but starchy legumes, such as beans and peas, contain less than 3%. Maize kernels contain up to 9% and wheat up to 4% of fat. The amount of fat in milk on an average is 4.25%, in whole hen's egg 10.5% and in the egg yolk 33.3%. Meat contains an extremely variable amount from less than 1 to over 95%.
Solvent extraction methods are usually applied to determine the amount of fat in food materials. The most widely used solvents are anhydrous ethylether and petroleum ether (b.p.35-40°C). Solvents like chloroform, carbontetra-chloride, carbon bisulphide and naphtha have been also tried, but were found unsuitable.

**ASH:**

The amount of ash remaining after the combustion of plant material varies considerably according to the part of plant.

Root and leafy vegetables and the fruits, although low in ash content on the fresh basis, when calculated to the dry substances may show a higher percentage than whole seeds. Parts of seeds, show a wider range for example, wheat grain seldom contains as high as 3.5% of ash, but the bran may contain 8% and the germ 5%; on the other hand, patent flour may contain only 0.3% and commonly about 0.5%.

Incineration in a muffle furnace is widely employed to determine the total ash of the food stuffs.
CARBOHYDRATES:

All living organisms ultimately derive their energy from the sun. Man can utilize certain but not all of the carbohydrates produced by plants. Carbohydrates, notably from cereal grains, represent the primary source of energy for the world's population. The low carbohydrates diet of the Eskimos and the high-carbohydrates diets of many oriental peoples indicate that man can be healthy with wide variations in carbohydrate intake.

Carbohydrate foods constitute a large variation of the human dietary. Carbohydrate occurs in plants in the sap; in fruits; as storage reserves in seeds, roots, and tubers; and as constituents of the structural tissues. They are also found in the milk of mammals and, to some extents, as a storage reserve in animals. These matureally occurring carbohydrates are either sugars or non-sugars.

The carbohydrate contents of food varies considerably. Cereals contain 79-25%, pulses and legumes 61-21%, leafy vegetables 57.8-1.4%, roots and tubers 50.0-1.7%, other vegetables 68.9-1.9%, nuts and oil seeds 33%, condiments and spices 69.4-3.0% and fruits 67.9-0.8%.

The methods devised for carbohydrate determination are legion; they include gravimetric, colorimetric and
titrimetric procedures only a few are stiochoimetric.\textsuperscript{20} Probably most used for general research work is the alkaline copper method developed by Shaffer, Hartmann and Somogyi.\textsuperscript{22-25}

**NITROGEN-PROTEIN**

The application of the importance of proteins in the history of scientific biochemistry, during first half of the nineteenth century.

The first systematic investigation of these nitrogen-containing materials was began during the 1830 by the Dutch chemist Gerardus Johnnes Mulder (1802-1880). While Mulder was investigating an organic substances appeared to be widely distributed in biological material, he received a letter from the great Swedish chemist Berzelins who suggested the term to him. Liebig \textsuperscript{28} after few years investigated the composition of several plant and animal proteins.

The term 'protein' is derived from the Greek word 'proteious' which means 'primary or holding first place'. They are present in the cytoplasm as well as the cell membrane of all cell without exception. Mammalian muscle contains about 20% protein, blood plasma 7%, cow's milk 3.5%. The vegetables richest in protein are the legumes-beans, peas
and lentilis, leafy, fruit and flower vegetables and tubers are of no value as source of protein. Hence, lettuce contain about 1.2%, asparagus 1.8%, cabbage 1.8%, cereals 8-15%, and oil seeds as high as 50%, cheese contains 25% protein. Lean meat about 20% all on the fresh basis.12

The protein, or more correctly the crude protein, of foods is calculated from the total nitrogen, best determined by the Kjeldahl's method, by either the general factor 6.25 or a special factor such as 6.38 for milk and milk products and 5.70 for wheat flour and its products. High protein is usually associated in oil seeds with high oil content, medium protein in cereals and various seeds with high starch content and low protein in sugar beets and certain fruits with relatively high sugar content.

**FIBRE:**

Fibre represents an indefinite sort of worthless material or roughage, bearing about the same relationship to nitrogen-free extract as sawdust does to starch. Although fibre has no appreciable food value, it functions in the intestine tract to give bulk to the contents and so stimulates intestinal actions.
Since fibre is cell wall material, no part of a natural vegetable substances is free from it. The amount ranges from less than 1% in some succulent fruits and vegetables to as 30% in cinnamon. The content in naked cereal grains seldom exceeds 3% and in wheat bran 11%. In white flour it may be as low as 0.06%. Nut shells and fruits stones, tree from kernels, contain as high as 60%.

**ALKALOID:**

From ancient times man has utilised alkaloids as medicines, poisons and magical portions. The term alkaloid, or "alkali like"; was first proposed by the pharmacist, W. Meissner, in 1819 applied to basic nitrogen containing compounds of plant origin. The alkaloids are not widely distributed in the vegetable kingdom; they are derived mainly from the angiosperms, the seed bearing or flowering plants. Alkaloids may occur in solution in the young parenchymatous tissue. The alkaloids are not free in the plant but are combined with some acid, in the form of a salt. In certain cases a specific acid is found associated with alkaloids derived from a definite source, such as quinic acid in the cinchona group, aconitic acid in the aconites, and meconic acid in the opium group.
The separation of mixtures of alkaloid so obtained can be very tedious task, but may be accomplished by fractional crystallisation, fractional precipitation, partition chromatography on columns, or by the counter current extraction. Alkaloids as a class have interested organic chemists partly on account of their physiological action on the animal organism, and partly on account of the complex structural and synthetical puzzles that they pose.

Biogenesis of alkaloids is that of pictet, who suggested that alkaloids are waste products and are produced in plants in two successive stages involving

(a) disruption of complex nitrogenous substances such as protein or chlorophyll with production of relatively simple fragments, and

(b) the recombination or condensation of the fragments with other substances present in the plant through secondary reaction such as methylation of hydroxy and imino group by the intervention of a formal dehyde.
DISCUSSION

The indigenous system of medicine practised in India is based mainly on the use of plants. It has been estimated that out of about 2000 drugs that have been used in curing human ailments in India, only about 200 are of animal origin and a similar number are of mineral origin. The rest i.e. about 1500 are of plant origin. This number is not very large considering the vast area of our country, and the wide variety of plant wealth occurring there in. The great range of temperature (about 49°c to -43°c), rainfall (sea-level to 600 m) in India account for the occurrence of some 20,000 different species of higher plants in India.

Eight medicinal plants which are mainly used in the treatment of diabetics and fevers were studied for proximate analysis. Presently, a number of institutions in India are actively engaged in research on medicinal plants and a good deal of information is being accumulated.
The following eight medicinal plants were selected for the proximate analysis.

**Medicinal Plants:**

<table>
<thead>
<tr>
<th>NO</th>
<th>BOTANICAL NAME</th>
<th>ENGLISH NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alhagi camelorum Fisch</td>
<td>Camel thorn</td>
</tr>
<tr>
<td>2</td>
<td>Crataeva religiosa Hook</td>
<td>Three leaved caper</td>
</tr>
<tr>
<td>3</td>
<td>Asparagus racemosus Willd</td>
<td>Wild asparagus</td>
</tr>
<tr>
<td>4</td>
<td>Swertia chirata Ham</td>
<td>Chiretta</td>
</tr>
<tr>
<td>5</td>
<td>Vernonia anthelmintica Willd</td>
<td>Purple flea bane</td>
</tr>
<tr>
<td>6</td>
<td>Holarrhena antidysenterica Wall</td>
<td>Easter tree or Ivory tree</td>
</tr>
<tr>
<td>7</td>
<td>Piper nigrum Linn</td>
<td>White pepper</td>
</tr>
<tr>
<td>8</td>
<td>Vitex negundo Linn</td>
<td>Five leaved chaste tree</td>
</tr>
</tbody>
</table>
Systematic investigation of drugs used in indigenous medicine in India on modern scientific lines was started more than fifty years ago. A number of medicinal plants prescribed by 'Kavirajas' and 'Hakims' have been examined, pharmacological action of the active principles worked out by animal experimentations and preparations made from the drugs have been tested on patients in hospitals. It is only by a thorough enquiry that the merits of these drugs can be proved and a demand created for them not only in India but also in other parts of the world.

Asoeva et al. studied different chemical composition of Alhagi camelorum roots and herbs and concluded that it contains some vitamins, ursolic acid and flavanoids. Bilgir analysed the nutritional value of Alhagi camelorum plant and determined the contents of ash, potassium, calcium, iron, proteins, cellulose, lipids, and starch.

The proximate analysis of Alhagi camelorum Fisch showed moisture, 6.40; fat, 7.30; ash, 8.50; carbohydrate, 6.85; total-nitrogen, 3.08; proteins, 19.25; starch and fibre; 51.70 percentage.

Bhandari and Bose examined the chemical constituent of stem bark of Crataeva religiosa Hook and concluded that the constituents were similar to the β-Sitosterol.
The proximate analysis of Crataeva religiosa Hook showed moisture, 6.87; fat, 1.33; ash, 6.90; carbohydrate, 5.25; total-nitrogen, 1.23; proteins, 7.69; starch and fibre, 71.98 percentage.

Subramanian and Nair\textsuperscript{32} studied chemical components of flowers and fruit of Asparagus racemosus Willd and found glycosides of quercetin, rutin and hyperoside. Free quercetin was also found in flowers. The roots contained no flavonoids, but steroid sapogenin was present. Sharma et al.

The proximate analysis of Asparagus racemosus Willd showed moisture, 5.11; fat, 1.10; ash, 3.90; carbohydrate, 1.61; total-nitrogen, 0.46; proteins, 2.88; and starch and fibre, 85.40 percentage.

Handa and Prabhakar modified the assay method for the bitter principle present in Swertia chirata Ham.

The proximate analysis of Swertia chirata Ham showed moisture, 4.71; fat, 5.33; ash, 9.81; carbohydrate, 0.90; total-nitrogen, 0.81; proteins, 5.06; and starch and fibre, 74.19 percentage.

Bhaduri\textsuperscript{35} studied the sugar and oil of seeds of Vernonia anthelmintica Willd. Vidyarthi\textsuperscript{36} showed the composition of fat acids obtained from the seeds of Vernonia anthelmintica.
Willd plant. Frost and Ward extracted sterols from seeds of plant and found stigmastadienol, and stigmasterol. Sanyal et al. isolated abscisic acid from leaf of Vernonia anthelmintica Willd. Asaka et al. separated a bitter principle (lactone) from seeds of Vernonia anthelmintica Willd.

The proximate analysis of Vernonia anthelmintica Willd showed moisture, 8.80; fat, 9.19; ash, 7.61; carbohydrate, 0.38; total-nitrogen, 1.31; proteins, 8.19 and starch and fibre, 65.83 percentage.

Ghosh and Ghosh found three alkaloids conessine, kurchicine and kurchine. Siddiqui and Parameswaram Pillay found three new alkaloids conessimine, Holarrhimine, Holarrhine and curchinine from the barks of Holarrhena antidysentrica plant. Chemical examination of barks of African Holarrhena by Siddiqui et al. showed the total alkaloid content to be 1.2% and conessine 0.7% as contrasted with Indian Holarrhena antidysentrica Wall which averages 2.2% total alkaloids but only 0.25% conessine. Ludvik and Vaclav isolated a new alkaloid from the bark of Holarrhena antidysentrica Wall namely Holarrhidine.

The proximate analysis of Holarrhena antidysentrica Wall showed the moisture, 8.85; fat, 7.75; ash, 5.51;
carbohydrate, 1.60; total-nitrogen, 3.29; proteins, 20.53; and starch and fibre, 55.76 percentage. The alkaloids conessimine, 0.12%; Holarrhimine, and Holarrhine, 0.03% were extracted.

Singh et al. extracted the piperidine and ß-sistostaol from stems of piper nigrum Linn plant. Scott and Kennedy analysed the white piper for the trace amount of aflatoxins. Nakatani et al. isolated two phenolic amides from the fruits of white pepper.

The proximate analysis Piper nigrum Linn showed the moisture, 8.01; fat, 11.90; ash, 4.69; carbohydrate, 0.28; total-nitrogen, 1.15; proteins, 7.19; and starch and fibre, 67.93 percentage. The alkaloids piperine and piperididine, 5.0%.

Basu and Singh investigated essential oil and alkaloid from the leaves of Vitex negundo Linn plant. Basu and Lamsal isolated from the leaves, on alkaloid nishindine possessing quinoline structure. Joshi et al. isolated sitosterol's from Vitex negundo Linn. Rao extracted sitosterol, vanillic acid, p-hydroxybenzoic acids, and luteolin from the bark of Vitex negundo Linn. Ferdous et al. isolated flavonoids from the leaves of Vitex negundo plant.
The proximate analysis of Vitex negundo Linn showed the moisture, 13.89; fat, 6.76; ash, 6.92; carbohydrate, 10.40; total nitrogen, 0.68; proteins, 4.13; and starch and fibre, 57.90 percentage. The alkaloid nishindine was present in a trace amount.

The results of proximate analysis is shown in table-I and table-II.
STANDARD GRAPH FOR CARBOHYDRATE

OPTICAL DENSITY AT 560 nm

CONCENTRATION OF GLUCOSE IN μg

0  50  100  150  200  250  300  350  400  450  500
### TABLE-I

**PROXIMATE ANALYSIS**

<table>
<thead>
<tr>
<th>NO</th>
<th>Name of Medicinal plants (English name)</th>
<th>Moisture %</th>
<th>Fat %</th>
<th>Ash %</th>
<th>Carbohydrates %</th>
<th>Total Nitrogen %</th>
<th>Proteins %</th>
<th>Starch &amp; Fibre %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alhagi camelorum Fisch (camel thorn)</td>
<td>6.40</td>
<td>7.30</td>
<td>8.50</td>
<td>6.85</td>
<td>3.08</td>
<td>19.25</td>
<td>51.70</td>
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<tr>
<td>2</td>
<td>Crataeva religiosa Hook (Three leaved caper)</td>
<td>6.87</td>
<td>1.33</td>
<td>6.90</td>
<td>5.25</td>
<td>1.23</td>
<td>7.69</td>
<td>71.98</td>
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<td>3</td>
<td>Asparagus racemosus Willd (wild asparagus)</td>
<td>5.11</td>
<td>1.10</td>
<td>3.90</td>
<td>1.61</td>
<td>0.46</td>
<td>2.88</td>
<td>85.40</td>
</tr>
<tr>
<td>4</td>
<td>Swertia chirata Ham (Chiretta)</td>
<td>4.71</td>
<td>5.33</td>
<td>9.81</td>
<td>0.90</td>
<td>0.81</td>
<td>5.06</td>
<td>74.19</td>
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<td>5</td>
<td>Vernonia anthelmintica Willd (Purple flea bane)</td>
<td>8.80</td>
<td>9.19</td>
<td>7.81</td>
<td>0.38</td>
<td>1.31</td>
<td>8.19</td>
<td>85.83</td>
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<td>6</td>
<td>Holarrhena antidysenterica Wall (Easter tree OR Ivory tree)</td>
<td>8.65</td>
<td>7.75</td>
<td>5.51</td>
<td>1.60</td>
<td>3.29</td>
<td>20.53</td>
<td>55.76</td>
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<td>7</td>
<td>Piper nigrum Linn (White pepper)</td>
<td>8.01</td>
<td>11.9</td>
<td>4.89</td>
<td>0.28</td>
<td>1.15</td>
<td>7.19</td>
<td>67.93</td>
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<td>8</td>
<td>Vitex negundo Linn (Five leaved chaste tree)</td>
<td>13.88</td>
<td>6.76</td>
<td>6.82</td>
<td>10.40</td>
<td>0.86</td>
<td>4.13</td>
<td>57.90</td>
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<td>NO</td>
<td>Name of Medicinal Plants</td>
<td>Alkaloids</td>
<td>Amount in Percent</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>----</td>
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</tr>
<tr>
<td>1</td>
<td>Holarrhena antidysenterica Wall</td>
<td>Conessine</td>
<td>0.40%</td>
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<tr>
<td></td>
<td></td>
<td>Conessimine</td>
<td>0.12%</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Holarrhine</td>
<td>0.03%</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Holarrhimine</td>
<td>0.005%</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>Piper nigrum Linn</td>
<td>Piperine</td>
<td>5.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>and</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Piperidine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Vitex negundo Linn</td>
<td>Nishindine</td>
<td>0.005%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ASPARAGUS RACEMOSUS WILLD

SWERTIA CHIRATA HAM
**EXPERIMENTAL**

The proximate analysis of the following eight medicinal plants were carried out on the basis of their chemical composition such as, moisture, fat, ash, carbohydrates, Nitrogen-protein, starch-fibre and alkaloids etc.

<table>
<thead>
<tr>
<th>No</th>
<th>Botanical name</th>
<th>English name</th>
<th>Selected part</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alhagi camelorum Fisch</td>
<td>Camel thorn</td>
<td>Stem</td>
</tr>
<tr>
<td>2</td>
<td>Crataeva religiosa Hook</td>
<td>Three leaved</td>
<td>Bark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>caper</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Asparagus racemosus</td>
<td>Wild asparagus</td>
<td>Root</td>
</tr>
<tr>
<td></td>
<td>Wildd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Swertia chirata Ham</td>
<td>Chiretta</td>
<td>Whole plant</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Vernonia anthelmintica</td>
<td>Purple flea</td>
<td>Fruit</td>
</tr>
<tr>
<td></td>
<td>Wildd</td>
<td>bane</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Holarrhena antidysentrica</td>
<td>Easter tree</td>
<td>Bark</td>
</tr>
<tr>
<td></td>
<td>Wall</td>
<td>or Ivory tree</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Piper nigrum Linn</td>
<td>White pepper</td>
<td>Fruit</td>
</tr>
<tr>
<td>8</td>
<td>Vitex negundo Linn</td>
<td>Five leaved</td>
<td>Leaves</td>
</tr>
</tbody>
</table>
These medicinal plants after identified by an expert Botanist, were collected from different regions. Their selected parts were dried thoroughly at room temperature, powdered and seived through a 60-80 mesh sieve. The individual dried samples thus obtained were kept in air tight dried glass bottles at room temperature and used for chemical analysis. The results were calculated on the dry basis of the medicinal plants.

**MOISTURE:** 52

In a 50 ml beaker (5.0 g) of the medicinal plants were weighted and then placed in an air-oven at 105°C. After 5 to 6 hours the beaker was transferred to a desiccator. The beaker was weighted along with dried contents. It was again placed in the air oven for one hour at 105°C, transferred to a desiccator and weighted again. This process was repeated till content in weight. From the loss in weight the amount of moisture per 100 gm of the sample was calculated.
For the extraction of fat from the dried sample the soxhlet extractor was used.

Finally powdered dried sample (8 to 10 gm) of the plant material was weighted on a fat free paper and hanged tightly on the upper portion of the extraction chamber, gripped on its sides. The bottom flask was filled with petroleum ether 40-80° c and refluxed on water condenser. The process of extraction was continued for 2 to 3 hours till ether condensing at the upper portion became colourless. The flask was disconnected from the condenser and the thimle containing the fat free material. The ethereal extract containing fat after evaporation of ether was then weighted. The fat content was calculated in terms of gram per 100 gm of plant material.

ASH

In a Silica crucible finely powdered dried sample (5.0 gm) of the plants material was weighed, ignited in a muffle furnace at about 600° c for 4 to 5 hours until a residual white ash was obtained. The crucible was cooled in a desiccator and weighed again. From the weight of the residual the amount of total ash per 100 gm of the medicinal plants
was calculated.

CARBOHYDRATE: 54

Finely powdered dried sample (0.4 gm) of the medicinal plants was dropped in 80% boiling ethanol and crushed thoroughly with sterilized sand to extract sugars. The solution was centrifuged. The supernatant was clarified with decoloursizing charcoal. The clear solution was hydrolysed with 1N Hydrochloric acid in a boiling water bath for 15 minutes. It was then neutralised with 1N Sodium hydroxide cooled, made up to volume and analysed for total sugars.

To 1-5 ml of sugar solution an equal volume of low-alkalinity copper reagent was added. Samples, blanks and standard sugar solutions were heated to 10 minutes in a vigorously boiling water bath and then cooled. 1-2 ml of arasenomolybdate reagent was then added when all the cuprous oxide was dissolved after mixing the solution was diluted to 10 ml mark on the colorimetric tube and the allowed to stand 15 minutes but not more than 40 minutes. Then, absorbance were read at 580 μm on MK (105) systronic made spectrophotometer. The average absorbance of the blank was subtracted from the average absorbance of the samples, then
the sugar content was computed from a curve previously established with standard sugar solutions.

**NITROGEN-PROTEIN:** 55-58

For the determination of the crude protein in the medicinal plant the total nitrogen was determined by the modification of semi-micro Kjeldahl's method.

In a semi-micro Kjeldahl's flask finely powdered dried sample (0.5 gm) of the medicinal plants, 1.0 gm of the catalyst mixture of copper sulphate, potassium sulphate and selenium dioxide (10:20:1) and 10 ml of conc. sulphuric acid were taken. The contents were mixed and the flask was heated over a low flame initially for thing stopped. The heating was then increased and digestion was prolonged for about 4-6 hours till a clear solution was obtained. It was then cooled, and contents and washings were transferred into the Kjeldahl's distillation apparatus through the funnel and set for distillation. Saturated sodium hydroxide (40%) was added dropwise from connected funnel until the solution became black. The liberated ammonia was absorbed in 100 ml of saturated boric acid solution containing 2 to 3 drops of a mixed indicator, prepared by mixing of 5 parts of 0.1% (w/v) alcoholic solution of bromocresol green and 2 parts of 0.1%
(w/v) alcoholic solution of methyl red and diluting the mixture to 30 ml with 95% alcohol, until it become green. It was then titrated against 0.04 hydrochloric acid solution until pink colour was obtained at the end point. The percentage of nitrogen was calculated according to the following formula.

\[
\text{percentage of nitrogen} = \frac{100 \times 0.0014 \times N \times Y}{0.1 \times g}
\]

Where \( Y \) = Titration Value in ml
\( g \) = Weight of the dried sample in gm
\( N \) = Normality of hydrochloric acid solution

Crude protein content was calculated by multiplying the percentage of nitrogen with 6.25.

**STARCH AND FIBRE ETC.**

After determination of percentage of moisture, fat, ash, nitrogen-protein and carbohydrate; the starch and fibre etc were calculated by difference.

The analytical data is recorded in Table-I and II.
THE DETERMINATION OF DIFFERENT ALKALOIDS WERE CARRIED OUT AS FOLLOWS:

PERCENTAGE OF ALKALOIDS IN HOLARRHENA ANTIDYSENTRICA WILLLD: 41

The 10.0 gm dry powdered bark was percolated eight times with a mixture of ether, alcohol and liquor NH₃ (80:10:10). The percolate was drawn out first after a week and later after every three days, gaseous HCl passed through it till just acidic and the ether decanted off from the precipitated hydrochlorides, made ammoniacal and used again. After two extractions the ethreal solution is distilled off.

The residue left after the distillation of the extracted medium gave small quantity of alkaloids which was added onto the main alkaloidal hydrochlorides. The total hydrochlorides were dissolved in water and treated with Sodium Sulphate which gave a cheese-like precipitate of insoluble Sulphates, which were filtered off and washed with water. The filtrate from the Sulphates was treated with 20 percent Sodium hydroxide and the alkaloids were extracted with ether.

The ether soluble alkaloids were treated with petroleum ether and the soluble portion treated with moist carbon dioxide which threw down on insoluble carbonate. After a long process of repeated fractionations, rendered necessary
because the separation of the different groups was not very clear, the bases were finally separated into three broad fractions:

(A) Sulphates insoluble in water
(B) Carbonates insoluble in petroleum ether and
(C) Non-carbonates soluble in petroleum ether.

**Conessine:**

The fraction (C) gave by direct crystallisation from acetone gave crude conessine, which was further purified by treatment with sodium nitrite in acetic acid solution. The yield was 0.4 percent.

**Conessimine:**

The fraction (B) of carbonates was dissolved in hydrochloric acid and fractionally precipitated with ammonia and sodium hydroxide. By a repeated fractionation three fractions gave some residual conessine and chiefly petroleum ether insoluble carbonates, the base from which was also added onto the middle basic fraction. This was now dissolved in hydrochloric acid and potassium iodide was added to the clear solution in small portions in the cold-bath, till the
fresh addition of it did not produce any further precipitate. The hydroiodide which came down as a thick oil, soon turned crystalline hydroiodide which was converted into base. It was dissolved in moist petroleum ether and a slow current of carbon dioxide passed through the solution at ordinary temperature. The base from the precipitated carbonates was dissolved in ethyl acetate and the solution was concentrated to a small volume and kept in a cold-bath after adding some water to it. The yield was 0.12 percent.

**Holarrhine:**

The combined insoluble sulphates were treated with 10 percent hydrochloric acid in the cold-bath which dissolved out the major portion, forming a deep red colour solution. The nearly white granular residue was then dissolved in hot 10 percent methyl alcoholic hydrochloric acid. The solution was neutralised with ammonia and an equal quantity of 1% sulphuric acid added to the solution in the hot. On cooling, white silky crystals of the sulphate separated out. The base from sulphate was dissolved in hot methyl alcohol and ethyl acetate. The yield was 0.03 percent.
Holarrhine:

On completely removing the solvent from the combined mother liquors of holarrhine, the hot ethyl acetate solution of the residue gave holarrhimine. The yield was 0.005 percent.

PERCENTAGE OF ALKALOID IN PIPER NIGRUM LINN:57

Finely powdered dried sample 20 gm of the plant material was repeatedly percolated with hot ethanol. The solvent was removed under reduced pressure. The residual mass was extracted repeatedly with hydrochloric acid (5N, 500 ml in three parts). The acid extracted solution was shaken with petroleum ether (b.p.40°-60°c) to remove oily impurity. It was then made alkaline with liquor ammonia and the liberated alkaloid were repeatedly extracted with chloroform. The chloroform extracts were combined and the solvent was evaporated and crude alkaloid hydrochloride was obtained. They were decomposed spontaneously with loss of hydrogen chloride in air. The alkaloid was crystallized from ethanol. From the weight of alkaloid the yield was found to be 5.0 percent.
PERCENTAGE OF ALKALOID IN VITEX NEGUNDO LINN: 58

(a) ISOLATION OF ALKALOID:

It was established in general that alkaloid is best extracted with alcohol in the cold, and that some mild alkali should be used to liberate the base, although prolonged contact with strong alkali should be avoided. 5 gm of dried powdered leaves was made into a paste with slaked lime and alcohol, and set aside for six hours. The mass was packed in a percolator and extracted with cold alcohol (93%). The solvent was distilled in vacuo, the residual syrup was mixed with powdered asbestos and evaporated on a water-bath until a semigranular residue remained. This was extracted with ether. The alkaloid was transferred to aqueous solution by shaking with successive quantities of N/3 hydrochloric acid until complete extraction resulted. It was then shaked with chloroform to remove colouring matter, and the acidic extract after filtration was made alkaline with dilute solution of ammonia and the liberated alkaloid extracted by chloroform. The mixture was washed with water, dehydrated and distilled.
(b) **PURIFICATION OF THE ALKALOID**

The residual alkaloid was dissolved in a few ml of chloroform. To this, ether was added drop by drop, immediate precipitation took place. The supernatant liquid was decanted off and the precipitate, which proved to consist mainly of resins and colouring matter, together with some alkaloid, was set concentrated and the residue was subjected to the same treatment till no separation of resin took place. Finally nishindine alkaloid was crystallised from 90% alcohol. The yield was 0.005 percent.