CHAPTER 1

INTRODUCTION
Since antiquity, man has to depend on nature for sustenance and survival on this planet. India is one of the richest floristic regions of the world and is well known for its ancient heritage regarding medicinal plants and plant drugs since time of the Rigveda. India has immense medicinal plant diversity and is situated in the tropical zone and one of 12 mega biodiversity countries having a vast variety of flora and fauna. Various Indian herbal remedies, e.g., smoking of datura in cases of asthma, use of nux vomica in paralysis, application of opium in diarrhoea and dyspepsia etc., found prominent place in the works of the great Grecian physician, Dioscorides.

All the major systems of medicine, e.g., Ayurveda, Unani and Homeopathy are largely based on drugs of plant-origin. The credibility of these systems, thus mainly depends upon the use of genuine raw materials in the manufacture of drugs of these systems. About 2000 medicinal plants are estimated to find regular use in the Indian System of Medicine. Of these, 500 medicinal plants are most commonly used in preparation of Indian Systems of Medicine and Homeopathy drugs. At present, there is a growing appreciation all over the world for the greater use of Indian traditional medicine to provide comparatively inexpensive and safe health care for the ailing masses. According to the Encyclopaedia Britannica (Macro, 23, 906, 1988), "Ayurvedic medicine" is an example of a well-organised system of traditional health care, both preventive and curative. It is still a form of health care in large parts of the Eastern world specially in India, where a large percentage of population use this system exclusively or combined with modern medicines. It provides health care to at least half-a-billion rural masses in India alone. Undoubtedly, we have a vast, promising and yet unexplored repository of medicinal plants, some of which are already in wide clinical use as crude drug preparations or formulations. Ayurveda is also considered as science of life, was coeval with the growth and evolution of Indian civilization and culture. Vedas, which are considered to be the repositories of recorded Indian culture, have mention of this knowledge both in theoretical and practical form. Aatharvaveda (one of the four most ancient books of Indian Knowledge, wisdom and culture) contains 114 hymns or formulations for the treatment of diseases. Ayurveda of the Indian Science of life originated and developed from these hymns. Thus Ayurveda is considered to
have divine origin representing one of the oldest organized system of medicine for positive health and cure of human sickness.

Ayurveda remains one of the most ancient and yet living traditions practiced widely in India, Sri Lanka and other countries and has a sound philosophical and experimental basis. Aatharvaveda (around 1200 B.C.), Charak Samhita and Sushrut Samhita (1000-500 B.C.) are the main classics that give a detailed description of over 700 herbs. Currently with over 400,000 registered Ayurveda practitioners, the Government of India has formal strictures to regulate issues related to quality, safety, efficacy and practice of herbal medicine. With unique holistic approach, Ayurvedic medicines are usually customized to an individual constitution.

Traditional medicine is used by up to 80% of people in the developing countries. The WHO strategy provides a policy framework to assist countries in regulating traditional medicine to make the use safer, more accessible and sustainable. In developing countries, where more than one third of the population lacks access to health services, the provision of safe and effective alternative medicine could become a critical tool for access to health care.

Though a large number of synthetic drugs have been discovered but importance of plant based drugs can not be ignored because of their safely, efficacy and better compatibility with the human body and lower side effects. The plant derived products form the backbone of Indian medicinal system. About 80% of the raw material for the drugs used in the Ayurvedic and Homeopathic system of medicine are based on plant derived products and are the principal support of 70-80% of the world population for their primary health care. Thus research on plant products is playing a significant role in the drug delivery process of the pharmaceutical industry and various other research organizations.

Flavonoids – The Natural Product Potential

Flavonoids are phenolic substances isolated from a wide range of vascular plants, with over 8000 individual compounds known. They act in plants as antioxidants, antimicrobials, photoreceptors, visual attractors, feeding repellants, and for light screening. Flavonoids exhibited biological activities, including antiallergenic, antiviral, anti-inflammatory, and vasodilating actions.
Flavonoids are found in fresh fruits and vegetables. Apart from various vegetables and fruits, flavonoids are found in seeds, nuts, grains, species, and different medicinal plant as well as in specific beverages such as red wine, tea and unfiltered beer. Particularly, red wine and tea contain high levels (approximately 200 mg per glass of red wine or cup of tea) of total phenols. Thus variations in consumption of these beverages are mainly responsible for the flavonoid intake in different national diets.

Flavonoids play various roles in the ecology of plants. Due to their attractive colours, flavones, flavonols, and anthocyanidins may act as visual signals for pollinating insects. Flavonoids act as catalysts in the light phase of photosynthesis and/or as regulators of iron channels involved in phosphorylation. They can also function as stress protectants in plant cells by scavenging reactive oxygen species produced by the photosynthetic electron transport system. Furthermore, because of their favorable UV-absorbing properties, flavonoids protect plants from UV radiation of sun and scavenge UV-generated ROS (reactive oxygen species). Fruits and vegetables do play a preventive role, which is due to a variety of constituents including vitamins, minerals, fiber, and numerous phytochemicals, including flavonoids. Thus, it is possible that flavonoids contribute to the protective effect of fruits and vegetables. This possibility has been evidenced by several in vitro, ex vivo and animal studies.

Various flavonoids isolated from the plants have been shown to have Antiviral, Antimicrobial, antimitotic, Cytotoxic, Antitumor and Antifungal. Several new flavone glycosides have been isolated by Dr. R.N. Yadava and his co-workers.

Tremendous advancement in chemical and biological sciences coupled with highly sophisticated methods like paper, column, thin-layer chromatography and spectral techniques like UV, IR, $^1$H-NMR, $^{13}$C-NMR and Mass, made it possible to isolate and characterize the therapeutically active constituents contained in medicinal plants.

Some recently isolated bioactive flavonoids are reported in Table-I.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Plant</th>
<th>Isolated Compound</th>
<th>Therapeutic importance</th>
<th>Stru.</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Monotes africanus</em></td>
<td>6,8-diprenylaromadendrin, 6,8-diprenyl kaempferol and Lonchocarpol A</td>
<td>Anti-HIV</td>
<td>1-3</td>
<td>58</td>
</tr>
<tr>
<td>2</td>
<td><em>Artocarpus champeden</em></td>
<td>Artoindonesianin A and Artoindonesianin B</td>
<td>Cytotoxic</td>
<td>4-5</td>
<td>59</td>
</tr>
<tr>
<td>3</td>
<td><em>Waldsteinia fragarioides</em></td>
<td>3, 3',4',5,7-pentahydroxyflavone-3β-O-glucoside (isoquercitrin)</td>
<td>Antiviral</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td><em>Celastrus orbiculatus</em></td>
<td>(-) Epicatechin-5-O-β-D-glucopyranosyl-3-benzoate and (-) Epicatechin-3-benzoate</td>
<td>Antioxidant</td>
<td>7-8</td>
<td>61</td>
</tr>
<tr>
<td>5</td>
<td><em>Physena madagascariensis</em></td>
<td>Remangi flavanone A and Remangi flavanone B</td>
<td>Antibacterial</td>
<td>9-10</td>
<td>62</td>
</tr>
<tr>
<td>6</td>
<td><em>Inula Britannica</em></td>
<td>Patuletin 7-O-(6''-isobutyl) glucoside, Patuletin 7-O-[6''-(2-methylbutyryl)]-</td>
<td>Antioxidant</td>
<td>11-22</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>glucoside, Patuletin 7-O-(6''-isovaleryl)-glucoside, Kaempferol 3-glucoside,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Isorhamnetin 3-glucoside, Hispidulin 7-glucoside, Patulitrin, Nepitrin, Kaempferol, Axillarin, Patuletin and Luteolin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><em>Artemisia indica</em></td>
<td>Exigua flavones A and Exigua flavones B</td>
<td>Antimalarial</td>
<td>23-24</td>
<td>64</td>
</tr>
<tr>
<td>8</td>
<td><em>Daphniphyllum calycinum</em></td>
<td>5,6,7,4'-tetrahydroxy flavonol-3-O-rutinoside and Kaempferol 3-O-neohesperidoside</td>
<td>Antioxidant</td>
<td>25-26</td>
<td>65</td>
</tr>
<tr>
<td>9</td>
<td><em>Tanacetum microphyllum</em></td>
<td>5, 7-dihydroxy-3, 6,4'-trimethoxy flavone (Santin) and 5,7-dihydroxy-3, 4'-dimethoxy flavone (Ermanin)</td>
<td>Antiinflammatory</td>
<td>27-28</td>
<td>66</td>
</tr>
<tr>
<td>10</td>
<td><em>Eysenhardtia polystachya</em></td>
<td>(3S)-7-hydroxy-2', 3', 4', 5', 8-pentamethoxy isoflavan and (3S)-3', 7-dihydroxy-2', 4', 5', 8-tetramethoxy isoflavan</td>
<td>Cytotoxic</td>
<td>29-30</td>
<td>67</td>
</tr>
<tr>
<td>S. No.</td>
<td>Plant</td>
<td>Isolated Compound</td>
<td>Therapeutic importance</td>
<td>Stru.</td>
<td>Ref.</td>
</tr>
<tr>
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</tr>
<tr>
<td>11.</td>
<td><em>Colutea arborescens</em></td>
<td>Coluteol (3’, 5’-dihydroxy-7, 2’, 4’-trimethoxy isoflavan) and Colutequinone B (7, 4’, 6’-trimethoxy isoflavan-2’, 5’-quinone)</td>
<td>Antifungal</td>
<td>31-32</td>
<td>68</td>
</tr>
<tr>
<td>14.</td>
<td><em>Broussonetia kazinoki</em></td>
<td>Broussonol A, Broussonol B, Broussonol C, Broussonol D and Broussonol E</td>
<td>Cytotoxic</td>
<td>50-54</td>
<td>71</td>
</tr>
<tr>
<td>15.</td>
<td><em>Neptunia oleracea</em> Lour</td>
<td>3, 5, 4’-trihydroxy-7, 3’-dimethoxy flavone-3-O-β-D-Xylopyranosyl-(1→2)-O-α-L-rhamnopyranoside</td>
<td>Antifungal</td>
<td>55</td>
<td>72</td>
</tr>
<tr>
<td>16.</td>
<td><em>Dichrostachys cinerca</em></td>
<td>5-hydroxy-7, 3’-4’-trimethoxy-5-O-α-L-rhamnopyranosyl-(1→2)-O-α-L-arabinopyranoside</td>
<td>Antibacterial</td>
<td>56</td>
<td>73</td>
</tr>
<tr>
<td>17.</td>
<td><em>Bauhinia restusa</em> Roxb.</td>
<td>7, 4’-dihydroxyflavone-7, O-β-D-galactopyranosyl-(1→2)-O-α-L-rhamnopyranoside</td>
<td>Anti-inflammatory</td>
<td>57</td>
<td>74</td>
</tr>
</tbody>
</table>
(7) R = β-D-glucose
(8) R = H

(9) R = H
(10) R = OH

(11) R = COCH(CH₃)₂
(12) R = COCH(CH₃)CH₂CH₃
(13) R = COCH₂CH(CH₃)₂

(14) R₁ = OGlc, R₂ = H, R₃ = H, R₄ = OH
(15) R₁ = OGlc, R₂ = OCH₃, R₃ = H, R₄ = OH
(16) R₁ = H, R₂ = H, R₃ = OCH₃, R₄ = OGlc
(17) R₁ = OH, R₂ = OH, R₃ = OCH₃, R₄ = OGlc
(18) R₁ = H, R₂ = OH, R₃ = OCH₃, R₄ = OGlc
(19) R₁ = OH, R₂ = H, R₃ = H, R₄ = OH
(20) R₁ = OCH₃, R₂ = OH, R₃ = OCH₃, R₄ = OH
(21) R₁ = OH, R₂ = OH, R₃ = OCH₃, R₄ = OH
(22) R₁ = H, R₂ = OH, R₃ = H, R₄ = OH
(23) $R = \text{CH}_3$

(24) $R = \text{H}$

(25)

(26)
(27)

(28)

(29) $R^1 = H, R^2 = \text{CH}_3$

(30) $R^1 = H, R^2 = H$

(31)

(32)
(33) $R_1 = C, R_2 = H, R_3 = Me$
(34) $R_1 = D, R_2 = R_3 = H$
(35) $R_1 = B, R_2 = Me$
(36) $R_1 = A, R_2 = H$
(37) $R_1 = C, R_2 = H$

A = \quad B =

(38)

(39) $R_1 = H, R_2 = A$
(40) $R_1 = A, R_2 = H$

(41) $R_1 = B, R_2 = H.$

(42)

(43)

(44)
(45) \( R = CH_2CH = C(CH_3)_2, \ R' = H \)
Thus a significant number of bioactive compounds have been isolated from various plants but still a large number of plants are left for their systematic phytochemical investigations. Therefore, author took up the challenging task of phytochemical examination of Compositae plants.

The Compositae or Astearaceae is one of the largest and most familiar families of flowering plants. Taxonomically the family, Compositae representing about 1310 genera and 13000 species. Compositae family are exceptionally very rich and distinct both in the range of secondary metabolites present and also in the number of complex structures. Various bioactive constituents obtained from this family showed significant medicinal importance.

Earlier workers have reported some bioactive constituents from Compositae plants which are recorded in Table-II.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gnaphalium Gaudichaudianum</td>
<td>Aerial part</td>
<td>5,8-dihydroxy-3,6,7-trimethoxy flavone and 5,8-dihydroxy-6,7-dimethoxy flavone</td>
<td>58-59</td>
<td>76</td>
</tr>
<tr>
<td>2</td>
<td>Baccharis Tucumanensis</td>
<td>Aerial part</td>
<td>Xanthomicrol and scutellarein-7,4'-dimethyl ether</td>
<td>60-61</td>
<td>77</td>
</tr>
<tr>
<td>3</td>
<td>Artemisia dracunculus</td>
<td>Aerial part</td>
<td>(Naringenin) 5,7,4'-tri hydroxy flavanone, 3,5,4'-trihydroxy-7-methoxy flavanone</td>
<td>62-64</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and 3,5,4'-tri hydroxy-7,3'-dimethoxy flavanone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Blumea balsamifera</td>
<td>Leaves</td>
<td>(2R, 3R)-Dihydro quercetin-4'-methyl ether and (2R, 3R)-Dihydro quercetin-4', 7-dimethyl ether</td>
<td>65-66</td>
<td>79</td>
</tr>
<tr>
<td>5</td>
<td>Acanthospermum glabratum</td>
<td>Whole plants</td>
<td>3,6-dimethoxy-4', 5, 7-trimethoxy flavone</td>
<td>67</td>
<td>80</td>
</tr>
<tr>
<td>6</td>
<td>Brickellia arguta</td>
<td>Stems, flowers and leaves</td>
<td>Isoxarbutin-3-D-β-D-glucoside, 6-methoxy kaempferol-3-D-β-D-(1,6)-robinoside, Quercetin 3, 7, 3'-tetramethyl ether and Quercetin 3, 3'-dimethyl ether</td>
<td>68-73</td>
<td>81</td>
</tr>
<tr>
<td>7</td>
<td>Neurolaena oaxacana</td>
<td>Leaves</td>
<td>6-hydroxy kaempferol 3, 7-dimethyl ether, Quercetin 3, 7-dimethyl ether, Quercetin 3, 3'-dime thyl ether (axillarin), 6-hydroxy luteolin 3'-methyl ether, 6-hydroxy luteolin 7-glucoside, 6-hydroxy kaempferol 3-methyl ether, Quercetin 3,7-dimethyl ether 6-galactoside, 6-hydroxy kaempferol 3-methyl ether-6-glucoside, Quercetin 3-methyl ether 7-glucoside, Kaempferol 3-glucoside, 6-hydroxy kaempferol 7-glucoside, Patulitirin, Quercetin 7-glucoside and Quercetin 3-methyl ether 7-sulfate</td>
<td>74-88</td>
<td>82</td>
</tr>
<tr>
<td>8</td>
<td>Tanacetum microphyllum</td>
<td>Aerial part</td>
<td>5, 7, 3'-tri hydroxy-3, 6, 4'-trimethoxy flavone (centaureidin) and 5, 3'-dihydroxy-4'-methoxy-7-carbomethoxy flavonol</td>
<td>89-90</td>
<td>83</td>
</tr>
<tr>
<td>9</td>
<td>Artemisia ludoviciana Var.</td>
<td>Aerial part</td>
<td>5,7,2',4'-tetrahydroxy-6,5'-dimethoxy flavone, 5,7,4'-tri hydroxy-6, 3', 5'-trimethoxy flavone, 5, 7, 3'-tri hydroxy-6, 4', 5'-trimethoxy flavone and 5,7,3', 4'-tetrahydroxy-6,5'-dimethoxy flavone</td>
<td>91-94</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>ludoviciana</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Artemisia mesatlantica</td>
<td>Aerial part</td>
<td>5, 4'-dihydroxy-6, 7, 3',5'-tetramethoxy flavone</td>
<td>95</td>
<td>85</td>
</tr>
</tbody>
</table>
(58) \( R = \text{OMe} \)

(59) \( R = \text{H} \)

\[
\begin{align*}
R^1 & \quad R^2 & \quad R^3 & \quad R^4 \\
(60) & \text{OMe} & \text{OMe} & \text{OMe} & \text{OH} \\
(61) & \text{H} & \text{OMe} & \text{OH} & \text{OMe}
\end{align*}
\]

(62)

(63)

(64)

(65) \( R = \text{H}, R' = \text{CH}_3 \)
(66) $R = H$, $R' = CH_3$

(67)

(68) $R_3 = H$, $R_2 = OH$, $R_1 = OCH_3$, $R_4 = \beta - D$-galactose

(69) $R_1 = R_3 = H$, $R_2 = OCH_3$, $R_4 = \beta - D$-glucose

(70) $R_2 = R_3 = H$, $R_1 = OCH_3$, $R_4 = \beta - D$-robinobiose

(71) $R_3 = H$, $R_2 = OH$, $R_1 = OCH_3$, $R_4 = \beta - D$-robinobioside

(72) $R_3 = R_4 = CH_3$, $R_1 = R_2 = OCH_3$

(73) $R_1 = R_3 = H$, $R_4 = CH_3$, $R_2 = OCH_3$

(74) $R_1 = Me$, $R_2 = H$

(75) $R_1 = Me$, $R_2 = OH$

(77) $R_1 = H$, $R_2 = Me$, $R_3 = OH$

(80) $R = R_2 = H$

(81) $R_1 = Me$, $R_2 = gal$, $R_3 = OH$

(82) $R_1 = R_3 = H$, $R_2 = glc$

(84) $R_1 = glc$, $R_2 = OH$

(85) $R_1 = glc$, $R_2 = OH$

(88) $R_1 = SO_3^-$, $R_2 = OH$
\( \text{(87) } R = \text{glc} \) 

\( \text{(86)} \) 

\( \text{(78) } R_1 = H, R_2 = H, R_3 = \text{Me} \) 

\( \text{(79) } R_1 = \text{glc}, R_2 = H, R_3 = H \) 

\( \text{(76) } R_1 = \text{Me}, R_2 = \text{OH} \) 

\( \text{(83) } R_1 = \text{glc}, R_2 = H \) 

\( \text{(89)} \) 

\( \text{(90)} \)
(91)  

(92) \( R_1 = H, R_2 = R_3 = R_4 = OMe \)

(93) \( R_1 = H, R_2 = R_4 = OMe, R_3 = OH \)

(94)  

(95)
Thus a deep sweep in the available literature reveals that there is still enough scope for further systematic phytochemical examinations of following Compositae plants.
2. *Enhydra fluctuans* Lour.

1. **ECHINOPS ECHINATUS ROXB.**

It is commonly known as ‘Gokru’ or ‘Utakanta’ in Hindi. It is a much-branched rigid annual 0.3-0.9 m. high, branches widely spreading from the base, white with cottony pubescence. Its leaves are sessile, 7.5-12.5 cm. long, glabrous or minutely scaberulous (rarely araneously pubescent) above, white with cottony wool beneath, oblong, deeply pinnatifid, the lobes triangular and oblong, sinuate and spinescent, the spines often 2.5 cm long. Balls of the heads white, 2.5-3.8 cm (rarely more) diameter (excluding the spines), segments of corolla-limb 5 by 0.85 mm, linear, acute. Involucres surrounded by strong white bristles resembling pappus-hairs; outer involucral bracts ob lanceolate, glabrous, pungent, intermediate bracts with 1 or 2 of the bracts often produced into sharp spines sometimes exceeding 2.5 cm long, causing the balls frequently to bristle with many spines, innermost bracts 5-8, nearly 13 mm long, connate for more than half their length into a tube round the achenes, the free segments acute, or obtuse and laciniate at the apex, ciliate and with scarious margins. Anther-tails fimbriate. Pappus short, yellowish, forming a short cylindric brush above the achene. Achenes 4 mm long, obconic, densely villous.

**DISTRIBUTION**

It is distributed throughout India and Afghanistan.

**MEDICINAL IMPORTANCE**

The plant is pungent, bitter, used in strangury, biliousness, urinary discharges, gleet, thirst, diseases of the heart. It is also used as antipyretic, analgesic and used in the treatment of ophthalmia, chronic fever, pains in the joints, inflammations, diseases of the brain and stimulates the liver. According to
Yunani system of medicine, its roots are aphrodisiac. At Hesargai, the roots are pounded and mixed with Acacia gum and applied to the hair to destroy lice. Its powdered roots are applied to wounds in cattle to destroy maggots (Hughes-Buller).

2. ENHYDRA FLUCTUANS LOUR.86-88

It is commonly known as 'Haruch' in Hindi. It is a marsh herb, usually quite glabrous, sometimes pubescent, glandular; stems 0.3-0.6 m, elongate, simple or divaricating, rooting at the nodes. Its leaves are sessile, linear-oblong, acute or obtuse, entire or subcuneate, 2.5-7.5 cm, variable in breadth, base narrowed or truncate. Heads axillary and terminal, sessile, 0.8-4.2 cm.

DISTRIBUTION

It is distributed throughout E. Bengal, Assam, Peninsula-Malaya and China.

MEDICINAL IMPORTANCE

According to Ayurvedic system of medicine, its leaves are slightly bitter, laxative, cure inflammation, leucoderma, bronchitis, biliousness and good in small pox. The leaves of this aquatic plant are regarded as laxative and useful in diseases of the skin and nervous system. The fresh juice of the leaves, in doses of about a tola, is prescribed by some Kavirajas in Calcutta, as an adjunct to tonic metallic medicines given in neuralgia and other nervous diseases.

Its leaves are antibilious. The expressed juice of the leaves are used as demulcent in cases of gonorrhoea when it is taken mixed with milk, either of cow or goat. The leaves are pounded and made into a paste which is applied cold over the head as a cooling agent. It is also useful in the torpidity of the liver.

3. ELEPHANTOPUS SCABER LINN.86-88

It is commonly known as 'Gobhi' in Hindi. It is an erect, 15-38 cm high, rootstock short, giving off many stout fibrous roots, stem usually dichotomously branched, strigose, with appressed white hairs. Its leaves are mostly radical, 12.5-20 by 3.8-5.7 cm, forming a spreading rosette on the ground, obovate-oblong, rounded or subacute, coarsely serrate-dentate, more or less hairy on both surfaces, base tapering into an obscure petiole, main nerves numerous
prominent beneath, with reticulate veins between, cauline leaves smaller than the radical, sessile. Heads numerous, sessile, closely packed, forming a large flattopped terminal inflorescence nearly 2.5 cm across and surrounded at the base by 3 large stiff broadly-ovate cordate conduplicate conspicuously nerved leafy bracts. Involucral bracts in 2 series enclosing 4 flowers, bracts of the outer row half as long as those of the inner, 1-nerved; bracts of the inner row usually 3- (rarely 5-) nerved, scarious, linear, cuspidate. Corolla violet, exserted, tube long, slender, limb deeply cleft on one side, causing the 5 linear lobes to present a palmate appearance. Pappus white, 1-seriate, consisting of 5 (rarely 4) rigid bristles dilated at the base. Achenes 5 mm long truncate, finely 10-ribbed, slightly pubescent. The embryo sometimes germinates in the head.

DISTRIBUTION

It is found throughout India, Tropical Asia, Australia and America.

MEDICINAL IMPORTANCE

The plant has a sharp, pungent, bitter taste, vulnerary, astringent to the bowels, antipyretic, alexipharmic, cures "kapha", biliousness, removes foul taste from the mouth. It is useful in all poisoning from the bites or from the nails of animals, good in diseases of the blood and the heart, urinary discharges, bronchitis, and small pox according to Ayurvedic system of medicine.

The herb is tasteless with a flavour, tonic, laxative, analgesic, used in griping, inflammations, tonic to the brain, lessens sleep. Its leaves are used in pains and piles. Its juice is a good collyrium. According to Unani system of medicine its flowers are aphrodisiac, tonic expectorant; cure biliousness, liver troubles, and cough, good in syphilis. In Travancore, a decoction of the roots and leaves is given in dysuria, the bruised leaves with rice are given internally for swellings or pains in the stomach. In Chota Nagpur, a preparation from the root is given for fever (Campbell).

Earlier workers have isolated several compounds from above these plants, which are listed in Table-III.
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>Echinops echinatus</em> Roxb.</td>
<td>Flowers</td>
<td>7-hydroxy echinozolinone</td>
<td>96</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Roots</td>
<td>ω-methyl allophanic acid and Allophanic acid</td>
<td>97-98</td>
<td>90</td>
</tr>
<tr>
<td>2.</td>
<td><em>Enhydra fluctuans</em> Lour.</td>
<td>Aerial part</td>
<td>4-hydroxy farnesyl acetate, fluctuadin, 8-Desacyl enhydrin tiglate, 8-Desacyl enhydrin-[4-hydroxy methacrylate], 8-Desacyl enhydrin-[4-hydroxy tiglate], 8-Desacyl enhydrin-(2, 3-epoxyisobutyrate), Enhydrin and 8β-methacryloyloxy-9-α-acetoxy-14oxo-acanthospermolide</td>
<td>99-105</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Whole plant</td>
<td>Enhydrin, Fluctuanin and fluctuadin (24S)-24-ethyl-5, 22, 25-cholestatriene-3β-yl stearate, and (24S)-24-ethyl-4, 22, 25-cholestatriene-3-one</td>
<td>106-108</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Whole plant</td>
<td>Enhydrin, (-)-Kaur-16-en-19-oic acid and (-)-16-α-hydroxy-kauran-19-oic acid</td>
<td>109-110</td>
<td>93</td>
</tr>
<tr>
<td>3.</td>
<td><em>Elephantopus scaber</em> Linn.</td>
<td>Whole plant</td>
<td>Lupeol, stigmasterol, and 11, 13-dihydrodeoxy elephantopin</td>
<td>114</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Whole plant</td>
<td>Deoxy elephantopin, Elephantopin and Elephantol methacrylate</td>
<td>115-117</td>
<td>96</td>
</tr>
</tbody>
</table>
R = CO(CH₂)₁₆CH₃

R₁ = \[
\begin{array}{c}
\text{CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂}
\end{array}
\]

(109)

R₁ = \[
\begin{array}{c}
\text{CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂}
\end{array}
\]

(110)

R = H₂

R₁ = \[
\begin{array}{c}
\text{CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂}
\end{array}
\]

(112)

R = \[
\begin{array}{c}
\text{CH₃-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂-CH₂}
\end{array}
\]

(114)

(111)
PROBLEM TAKEN AND WORK DONE

Recently, various synthetic drugs have been discovered and are used on a large scale but still no system of medicine in the world can claim to have obtained complete expertise in solving all health problems. Still several diseases like AIDS, cancer etc. exists a great concern for the survival of humanity. There are a large number of medicinal plants which have not been investigated thoroughly and hence their curative values have not been recognized.

Thus there is urgent need for systematic phytochemical investigation of those indigenous plants which have not been investigated systematically or worked at a time when modern facilities were not available for their potential therapeutic component. Therefore in view of the medicinal importance of Compositae plants, author took up the challenging task to examine plants (i) Echinops echinatus Roxb. (ii) Enhydra fluctuans Lour. and (iii) Elephantopus scaber Linn. with a view to isolate, purify and identify bioactive flavonoidal constituents present in them. The findings are summarized below.

CHAPTER-2

ISOLATION AND CHARACTERISATION OF A NEW ANTIBACTERIAL PRENYL FLAVONOL GLYCOSIDE : 3, 5, 7-TRIHYDROXY-8-PRENYL FLAVONE-3-O-β-D-XYLOPYRANOSYL-(1→3)-O-β-D-GALACTO-PYRANOSYL-7-O-α-L-RHAMNOPYRANOSIDE FROM THE ROOTS OF ELEPHANTOPUS SCABER LINN.

This chapter incorporates the isolation and structural elucidation of a new antibacterial prenyl flavonol glycoside (SS) (yield 2.05 gm) molecular formula C_{37}H_{46}O_{18}, m.p. 245-248°C and [M]+778 (FABMS) obtained from the acetone soluble part of ethanolic extract of roots of this plant. Its structure was established as 3, 5, 7-trihydroxy- 8-prenyl flavone-3-O-β-D-xylopyranosyl-(1→3)-O-β-D- galactopyranosyl-7-O-α-L-rhamnopyranoside on the basis of various colour reactions, alkaline degradations and spectral techniques.
CHAPTER 3

ISOLATION AND STRUCTURAL ELUCIDATION OF A NOVEL BIOACTIVE ISOFLAVONE GLYCOSIDE: 4', 5, 6, 7-TETRAHYDROXY-8-METHOXY ISOFLAVONE-7-O-β-D-GALACTOPYRANOSYL-(1→3)-O-β-D-XYLOPYRANOSYL-(1→4)-O-α-L-RHAMNOPYRANOSIDE, FROM THE LEAVES OF ENHYDRA FLUCTUANS LOUR.

A novel bioactive isoflavone glycoside (SK) (yield 2.24 gm) obtained from methanol soluble fraction of the ethanolic extract of the leaves of this plant which had molecular formula C_{33}H_{46}O_{20}, m.p. 295-297°C and [M]+ 756 (FABMS). Its structure has been characterised as 4', 5, 6, 7-tetrahydroxy-8-methoxy isoflavone-7-O-β-D-galactopyranosyl-(1→3)-O-β-D-xylopyranosyl-(1→4)-O-α-L-rhamnopyranoside by various chemical degradations, colour reactions and spectral analysis.

CHAPTER 4

ISOLATION AND STRUCTURAL ELUCIDATION OF A NEW ANTI-INFLAMMATORY FLAVANONE GLYCOSIDE: 5,7-DIHYDROXY-8, 4'-DIMETHOXY FLAVANONE-5-O-α-L-RHAMNOPYRANOSYL-7-O-β-D-ARABINOPYRANOSYL-(1→4)-O-β-D-GLUCOPYRANOSIDE FROM THE LEAVES OF ECHINOPS ECHINATUS ROXB.
A new anti-inflammatory flavonone glycoside (SU) (yield 2.35 gm) molecular formula C_{24}H_{44}O_{19}, m.p. 238-241°C, [M]^+ 756 (FABMS) isolated from the methanol soluble fraction of ethanolic extract of leaves of this plant. On the basis of various colour reactions, alkaline degradations and spectral techniques, its structure was identified as 5, 7-dihydroxy-8, 4'-dimethoxy flavanone-5-O-α-L-rhamnopyranosyl-7-O-β-D-arabinopyranosyl-(1→4)-O-β-D-glucopyranoside.

CHAPTER-5

ISOLATION AND CHARACTERISATION OF A NOVEL FLAVONE GLYCOSIDE: 2', 5, 7-TRIHYDROXY -3,6-DIMETHOXY FLAVONE-7-O-β-D-GALACTOPYRANOSYL-(1→4)-O-α-L-RHAMNOPYRANOSIDE FROM THE SEEDS OF ECHINOPS ECHINATUS ROXB.

This chapter includes the isolation and structural elucidation of a novel flavone glycoside (SM) obtained from chloroform soluble fraction of the ethanolic extract of the seeds of Echinops echinatus Roxb. The compound (SM) (yield 2.18 gm) had molecular formula C_{29}H_{34}O_{16}, m.p. 256-258°C and [M]^+638 (FABMS). Its structure was characterised as 2', 5, 7-trihydroxy -3,6-dimethoxy flavone -7-O-β-D-galactopyranosyl-(1→4)-O-α-L-rhamnopyranoside by different colour reactions, alkaline degradations and spectral techniques.
REFERENCES


