CHAPTER I

INTRODUCTION
Since primitive days plant material have been used as household remedies by common people in India. Plant materials have been used by human beings not only for daily needs but also for the treatment of various ailments. The importance of plant products came into cognizance because of ever-increasing evidence of the efficacy of various plant based drugs used by Tribal and Rishi’s in preventive and curative aspects of health care.

The World Health Organization (WHO) estimated that 80% of the population of developing countries rely on traditional medicines, mostly plant based drugs, for their primary health care needs. Modern pharmacopoeias contain at least 25% drugs derived from plants. Demand for medicinal plant is increasing in both developing and developed countries due to growing recognition of natural products, being non-narcotic, having no side-effects, easily available at affordable prices. Medicinal plant sector has traditionally occupied an important position in the socio cultural, spiritual and medicinal arena of rural and tribal lives of India.

According to an all India ethnobiological survey carried out by the Ministry of Environment & Forests, Government of India, there are over 8000 species of plants being used by the people of India. Millions of rural people use medicinal plants for household remedies. Over one and a half million practitioners of the Indian system of medicine use medicinal plants in preventive, promotive and curative applications. Though India has a rich biodiversity, the growing demand is putting a heavy strain on the existing resources. Therefore the cultivation of medicinal plant has to be encouraged for meeting the future needs.

Plants form a dominant role in Ayurveda. Ayurveda is India’s traditional, natural system of medicine that has been practiced for more than 5,000 years. The detailed descriptions of the various practices were written by Charaka, Sushruta, and Vagbhata, which have been described in Ayurveda. Charaka listed 500 remedies and Sushruta over 700 vegetable medicines. Ayurveda emphasizes prevention of disease, rejuvenation of our body systems, and extension of life span. Ayurveda provides an integrated approach to preventing and treating illness through lifestyle interventions and natural therapies. Medicinal plants are found in abundance in India. Plants contain a variety of chemical substances that act upon the body. Pharmaceuticals companies are currently conducting research on plants for their therapeutic value. Today, plant based
products remain the basis for a large proportion of the commercial medications used for the treatment of high blood pressure, heart diseases, asthma, pain and other diseases. Ephedrine, the active constituent isolated from Ephedra, is used in the commercial pharmaceutical preparations for the relief of asthma and other respiratory problems. The powdered leaf of the plant foxglove is known as the cardiac stimulant digitalis to the million of heart patients. Vinca extract is used today in modern medicine to treat cancer, (leukaemia-search Sandoz) while Rauwolfia is useful for cardiac disorders and reduction of anxiety. The smoke from dry Datura leaves helps in asthma. Saponins obtained from the bark of Quillaja saponaria Mol. (soap-bark tree) has been used as an active adjuvant for vaccination. Formosanin-C, a Diosgenin saponin from Paris formosana, increases the natural immune defense against malignant cells by activating natural killer cells. Sarsaponins obtained from Yucca is occasionally grazed by cattle and also, beneficial to rumen digestion.

Various saponins are diuretic. In humans, this effect disappears within a week following the neutralizing action of cholesterin. Alfalfa saponins may have potential in human health issues because they reduce serum cholesterol by preventing its reabsorption after it has been excreted in the bile. Unfortunately, the feeding of alfalfa saponins to hens has not resulted in low cholesterol eggs.

Various triterpenoid saponins isolated from the plants have been shown to have Antimicrobial, Antitumor, Antiviral, Cardiovascular, Molluscidal, Spermicidal and antiaging activity.

Isolation and characterization of active constituents from plants are being successfully carried in India because of the tremendous advancement of highly sophisticated spectral techniques like IR, 1H-NMR, 13C-NMR and Mass. Thus natural product research plays a significant role in the drug discovery process of pharmaceutical industries and other research organizations.

Some recently isolated bioactive triterpenoid saponins are reported in Table-I.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Plant</th>
<th>Isolated Compounds</th>
<th>Bioactivity</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>Orthosiphon stamineus</em></td>
<td>16β-hydroxybetulinic acid (S-1)</td>
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<td>26</td>
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<td>2.</td>
<td><em>Ixora finlaysoniana</em></td>
<td>3-O-β-D-glucopyranosyl-2α-19α-dihydroxyurs-12-ene-28-oic acid-β-D-glucopyranosyl ester (S-2) and 2α-3α-19α-tri hydroxyurs-12-ene-28-oic acid-β-D-galactopyranosyl ester (S-3)</td>
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<td>3.</td>
<td><em>Boswellia serrata</em></td>
<td>20, 24-dihydroxyeupha-2,8,22-triene (S-4)</td>
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<td>28</td>
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<td>4.</td>
<td><em>Cassia javanica</em></td>
<td>2α,3β,19α-trihydroxy olean-12-en-28-oic acid-28-O-β-D-xylopyranoside (S-5)</td>
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<td>5.</td>
<td><em>Terminalia arjuna</em></td>
<td>2α,19α-dihydroxy-3-oxo-olean-12-en-28-oic acid-28-O-β-D-glucopyranoside (S-6)</td>
<td>Antifungal</td>
<td>30</td>
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<td>6.</td>
<td><em>Adina pilulifera</em></td>
<td>3β-O-β-D-xylospyranosyl-(1→3)-α-L-rhamnopyranosyl-pyreocinholic acid 28-O-β-D-glucopyranosyl (1→6)-β-D-glucopyranosyl ester (S-7) and 3β-O-β-D-xylospyranosyl-(1→3)-α-L-rhamnopyranosyl-cincholic acid 28-O-β-D-glucopyranosyl ester (S-8)</td>
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<td>7.</td>
<td><em>Dendrocalamus strictus</em></td>
<td>3β,21β,28-trihydroxyolean-12-en-28O-{β-D-arabinopyranosyl-(1→3)}-β-D-arabinopyranosyl (1→3)-β-D-arabinopyranoside (S-9) and 3β,19α-dihydroxyurs-12-en-28-oate-3-O-β-D-arabinopyranoside (S-10)</td>
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<td>8.</td>
<td><em>Cassia auriculata</em></td>
<td>3β, 24-dihydroxyurs-12-en-28-oic acid-24-O-β-D-xylopyranoside (S-11) and 3β,24-dihydroxyurs-12-en-28-oic acid-3-O-β-D-xylopyranoside (S-12)</td>
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<td>9.</td>
<td><em>Ilex oblonga</em></td>
<td>Oblonganoside A (S-13); Oblonganoside B (S-14); Oblonganoside C (S-15); Oblonganoside D (S-16); Oblonganoside E (S-17) and Oblonganoside F (S-18)</td>
<td>Inhibitory</td>
<td>34</td>
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<td>10.</td>
<td><em>Sophora koreensis</em></td>
<td>3-O-α-L-rhamnopyranosyl(1→2)-α-L-arabinopyranosyl(1→2)-β-D-glucuronopyranosyl kudzusapogenol A 22-O-α-L-arabinopyranoside (S-19); 3-O-α-L-rhamnopyranosyl(1→2)-α-L-arabinopyranosyl(1→2)-β-D-glucuronopyranosyl abrisapogenol C 22-O-α-L-arabinopyranoside (S-20) and 3-O-α-L-rhamnopyranosyl(1→2)-α-L-arabinopyranosyl(1→2)-β-D-glucuronopyranosyl kudzusapogenol A 22-O-acetate (S-21)</td>
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<td>S. No.</td>
<td>Plant</td>
<td>Isolated Compounds</td>
<td>Bioactivity</td>
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<td>11.</td>
<td><em>Gypsophila oldhamiana</em></td>
<td>3-O-β-D-galactopyranosyl-(1→2)-[β-D-xylopyranosyl-(1→3)]-β-D-glucuronopyranosyl quillaic acid 28-O-α-L-arabinopyranosyl-(1→2)-α-L-arabinopyranosyl-(1→3)-β-D-xylopyranosyl-(1→4)-α-L-rhamnopyranosyl-(1→2)-β-D-fucopyranoside (S-22); 3-O-β-D-galactopyranosyl-(1→2)-[β-D-xylopyranosyl-(1→3)]-methyl-β-D-glucuronopyranosyl gypsogenin 28-O-β-D-glucopyranosyl-(1→3)-[β-D-xylopyranosyl-(1→4)]-α-L-rhamnopyranosyl-(1→2)-β-D-fucopyranoside (S-23) and 23-O-β-D-glucopyranosyl gypsogenic acid 28-O-β-D-glucopyranosyl-(1→3)-[β-D-glucopyranosyl-(1→6)]-β-D-glucopyranoside (S-24)</td>
<td>Inhibitory activity</td>
<td>36</td>
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<td>12.</td>
<td><em>Akebiae quinata</em></td>
<td>3-O-β-D-xylopyranosyl-(1→2)-α-L-arabinopyranosyl gypsogenin (S-25); 3-O-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranosyl gypsogenin (S-26) and 3-O-β-D-xylopyranosyl-(1→2)-α-L-arabinopyranosyl-(1→6)-β-D-glucopyranosyl gypsogenin (S-27)</td>
<td>-</td>
<td>37</td>
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<td>13.</td>
<td><em>Achyranthes fauriei</em></td>
<td>Chikusetsusaponin Iva (S-28)</td>
<td>Cytotoxic activity</td>
<td>38</td>
</tr>
<tr>
<td>14.</td>
<td><em>Platycodon grandiflorum</em></td>
<td>3-O-β-D-glucopyranosyl-(1→6)-β-D-glucopyranosyl-2β,3β,16β,23-tetrahydroxylean-12-en-28-oic acid 28-O-β-D-xylopyranosyl-(1→4)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside (S-29); 3-O-β-D-glucopyranosyl-(1→6)-β-D-glucopyranosyl-2β,3β,16α,23-tetrahydroxylean-12-en-28-oic acid 28-O-β-D-xylopyranosyl-(1→4)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside (S-30); 3-O-β-D-glucopyranosyl-2β,3β,16α,23-tetrahydroxylean-12-en-28-oic acid 28-O-β-D-xylopyranosyl-(1→4)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside (S-31); 3-O-β-D-glucopyranosyl-(1→3)-β-D-glucopyranosyl-2β,3β,16α,23,24-pentahydroxylean-12-en-28-oic acid (S-32) and 3-O-β-D-glucopyranosyl-(1→6)-β-D-glucopyranosyl-2β,3β,16α,23,24-pentahydroxylean-12-en-28 oic acid (S-33)</td>
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<td>15.</td>
<td><em>Bacopa monniera</em></td>
<td>3-O-α-L-arabinofuranosyl (1→2)-β-D-glucopyranosyl jujubogenin (S-34); 3-O-β-D-glucopyranosyl (1→3)-α-L-arabinopyranosyl jujubogenin (S-35) and 3-O-β-D-glucopyranosyl-(1→3)-α-L-arabinopyranosyl pseudojujubogenin (S-36)</td>
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<td><em>Aralia elata</em></td>
<td>Hederagenin 3-O-β-D-glucopyranosyl(1→3)-β-D-glucopyranosyl(1→3)-α-L-arabinopyranoside (S-37)</td>
<td>-</td>
<td>41</td>
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<td>17.</td>
<td><em>Aesculus assamica</em></td>
<td>28-O-acetyl-21-O-(4-O-angeloyl)-6-deoxy-β-glucopyranosyl-3-O-[β-glucopyranosyl(1→2)-O-[β-glucopyranosyl(1→4)]-β-glucuronopyranosyl protoaeescigenin (S-38) and 21-O-(4-O-angeloyl)-6-deoxy-β-glucopyranosyl-3-O-[β-glucopyranosyl(1→2)-O-[β-glucopyranosyl(1→4)]-β-glucuronopyranosyl protoaeescigenin (S-39)</td>
<td>In vitro, cytotoxicity</td>
<td>42</td>
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<td>S. No.</td>
<td>Plant</td>
<td>Isolated Compounds</td>
<td>Bioactivity</td>
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<td>18.</td>
<td>Cephalaria gigantea</td>
<td>3-O-[β-D-galactopyranosyl-(1→2)]-β-D-glucuronopyranosyl]-28-O-[β-D-glucopyranosyl-(1→6)]-β-D-glucopyranosyl]-oleanolic acid (S-40); 3-O-[β-D-galactopyranosyl-(1→2)]-β-D-glucuronopyranosyl]-28-O-[β-D-glucopyranosyl-(1→6)]-β-D-glucopyranosyl]-hederagenin (S-41) and 3-O-[α-L-rhamnopyranosyl-(1→2)]-β-D-glucuronopyranosyl]-28-O-[β-D-glucopyranosyl-(1→6)]-β-D-glucopyranosyl]-hederagenin (S-42)</td>
<td>Cytotoxic</td>
<td>43</td>
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<td>19.</td>
<td>Polygala japonica</td>
<td>3-O-β-D-glucopyranosyl medicagenic acid 28-O-[β-D-xlyopyranosyl-(1→4)]-[β-D-apiofuranosyl-(1→3)]-α-L-rhamnopyranosyl-(1→2)-β-D-glucopyranosyl ester (S-43) and 3-O-β-D-glucopyranosyl 2-oxo-olean-12-en-23, 28-dioic acid 28-O-[β-D-xlyopyranosyl-(1→4)]-[β-D-apiofuranosyl-(1→3)]-α-L-rhamnopyranosyl-(1→2)-β-D-glucopyranosyl ester (S-44)</td>
<td>-</td>
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<td>21.</td>
<td>Lysimachia davurica</td>
<td>3-O-β-D-glucopyranosyl-(1→2)-β-D-glucopyranosyl-(1→4)]-α-L-arabinopyranosyl]-13,28-epoxy-3β-hydroxy-16-oleanane (S-51); 3-O-β-D-glucopyranosyl oxyuronic acid-(1→2)-β-D-xylpyranosylcyclamiretin A (S-52) and 3-O-β-D-glucopyranosyl-(1→2)-α-L-arabinopyranosyl-cyclamiretin A (S-53)</td>
<td>Cytotoxic</td>
<td>46</td>
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<td>22.</td>
<td>Platycodon grandiflorum</td>
<td>3-O-β-D-glucopyranosyl platyecogenic acid A lactone (S-54); 3-O-β-D-glucopyranosyl platyecogenic acid A lactone 28-O-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside (S-55) and 3-O-β-D-glucopyranosyl platyecogenic acid A lactone 28-O-β-D-xylpyranosyl-(1→4)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside (S-56)</td>
<td>-</td>
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<td>S. No.</td>
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<td>Isolated Compounds</td>
<td>Bioactivity</td>
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<td>23.</td>
<td><em>Panax quinquefolium</em></td>
<td>(3β, 6α, 12β, 20E)-24, 25-epoxy-3, 12, 23-trihydroxydammar-20(22)-en-6-O-α-L-rhamnopyranosyl(1→2)-β-D-glucopyranoside (S-57)</td>
<td>-</td>
<td>48</td>
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<td>24.</td>
<td><em>Hedera colchica</em></td>
<td>3-O-(β-D-xylopyranosyl)-hederagenin (S-58) and 3-O-[α-L-rhamnopyranosyl-(1→3)]β-D-glucuronopyranosyl-28-O-[α-L-rhamnopyranosyl-(1→4)]β-D-glucopyranosyl(1→6)-β-D-glucopyranosyl-Oleanolate (S-59)</td>
<td>-</td>
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<td><em>Aesculus chinensis</em></td>
<td>21, 28-di-O-acetylprotoescigenin-3-O-[β-D-glucopyranosyl(1→2)]β-D-glucopyranosyl(1→4)]-β-D-glucopyranosiduronic acid (S-60)</td>
<td>Anti-inflammatory</td>
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<td><em>Terminalia glabrescens</em></td>
<td>3β, 6β, 23, 28-tetradroxyolean-12-eno (S-61)</td>
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<td>27.</td>
<td><em>Sinocrassula asclepiadea</em></td>
<td>3β, 16α-dihydroxyolean-12-en-23, 28-dioic acid 28-O-[β-D-glucopyranosyl(1→3)]-β-D-glucopyranosyl-(1→6)-β-D-glucopyranosyl ester (S-62); 3β, 16α-dihydroxyolean-12-en-23, 28-dioic acid 28-O-[β-D-glucopyranosyl-(1→3)]-β-D-glucopyranosyl ester (S-63); 3β, 16α-dihydroxyolean-12-en-23, 28-dioic acid 28-O-[β-D-glucopyranosyl(1→3)]-β-D-glucopyranosyl-(1→6)-β-D-glucopyranosyl ester (S-63); 3β, 16α-dihydroxyolean-12-en-23, 28-dioic acid 28-O-[β-D-glucopyranosyl(1→3)]-β-D-glucopyranosyl-(1→6)-β-D-glucopyranosyl ester (S-64); 3β, 16α-dihydroxy-3, 4-seco-olean-4(24), 12-dien 23, 28-dioic acid 28-O-[β-D-glucopyranosyl(1→3)]-β-D-glucopyranosyl-(1→6)-β-D-glucopyranosyl ester (S-65) and 3β, 16α-dihydroxy-3, 4-seco-olean-4(24), 12-dien 23, 28-dioic acid 28-O-[β-D-glucopyranosyl(1→3)]-β-D-glucopyranosyl and 28-O-[β-D-glucopyranosyl(1→3)]-β-D-glucopyranosyl ester (S-66)</td>
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<td>29.</td>
<td><em>Ardisia mamilata</em></td>
<td>3-O-[α-L-rhamnopyranosyl-(1→2)]-β-D-glucopyranosyl-13β, 28-epoxy-16-oxo-oleanan-3β, 30-diol (S-67) and 3-O-[α-L-rhamnopyranosyl-(1→2)]-β-D-glucopyranosyl-13β, 28-epoxy-16-oxo-oleanan-30-al (S-68)</td>
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<td><em>Holboellia fargesii</em></td>
<td>3β, 20α-dihydroxy-29-norolean-12-en-28-oic acid 3-O-β-D-xylopyranosyl(1→2)-β-D-glucopyranoside (S-69); 3β, 20α, 24-trihydroxy-29-norolean-12-en-28-oic acid 23-O-β-D-fucopyranosyl(1→2)-α-L-arabinopyranosyl(1→3)]-β-D-glucopyranoside (S-70); 3β, 23-dihydroxy-30-norolean-2, 20(29)-dien-28-oic acid 3-O-α-L-arabinopyranosyl-(1→2)]-β-D-glucopyranosylureonoluronic acid (1→3)-α-L-arabinopyranoside (S-71); 3β, 23-dihydroxy-30-norolean-12, 20(29)-dien-28-oic acid 3-O-methyl β-D-glucopyranosyl uronate-(1→3)-α-L-arabinopyranoside (S-72) and 3β, 23-dihydroxy-olean-12-en-28-oic acid 3-O-methyl β-D-glucopyranosyluronate-(1→3)-α-L-arabinopyranoside (S-73)</td>
<td>-</td>
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<td>31.</td>
<td><em>Ilex latifolia</em></td>
<td>3-O-β-D-glucopyranosyl-(1→3)-[α-L-rhamnopyranosyl-(1→2)]-α-L-arabinopyranosyl 3β-hydroxy-urs-12,18-dien-28-oic acid 28-O-β-D-glucopyranosyl ester (S-74) and 3-O-β-D-glucopyranosyl-(1→2)-β-D-glucopyranosyl-(1→3)-[α-L-rhamnopyranosyl-(1→2)]-α-L-arabinopyranosyl 3β,19α-dihydroxyursolic acid (S-75)</td>
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<td><em>Maesa tenera</em></td>
<td>3-O-[β-D-glucopyranosyl-(1→2)-α-L-rhamnopyranosyl-(1→2)-β-D-galactopyranosyl-(1→3)][β-D-glucopyranosyl-(1→2)]-β-D-glucuronopyranosyl camelliaogenin A 22-O-angelate (S-76) and 3-O-[α-L-rhamnopyranosyl-(1→2)-β-D-galactopyranosyl-(1→3)][β-D-glucopyranosyl-(1→2)]-β-D-glucuronopyranosyl-camelliaogenin A 22-O-angelate (S-77)</td>
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<td><em>Calendula officinalis</em></td>
<td>3β-acetoxy-olean-12-ene-27-oic acid (S-78)</td>
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<td>34.</td>
<td><em>Pluchea lanceolata</em></td>
<td>14,15-seco-urs-18βH-20 (30)-en-3β-yl acetate (S-79)</td>
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<td><em>Aster albenscens</em></td>
<td>Medicagenic acid-3-O-[β-D-glucopyranosyl-(1→3)-β-D-glucopyranosyl]-28-O-[β-D-xylopyranosyl-(1→4)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranosyl]-ester (S-80); Medicagenic acid-3-O-[β-D-glucopyranosyl]-28-O-[α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranosyl]-ester (S-81) and Medicagenic acid-3-O-[β-D-glucopyranosyl]-28-O-[β-D-xylopyranosyl-(1→4)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranosyl]-ester (S-82)</td>
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<td><em>Celmisia petriei</em></td>
<td>3-O-(α-L-arabinopyranosyl-(1→6)-β-D-glucopyranosyl-(1→2)-α-L-arabinopyranosyl)-2β,17,23-trihydroxy-28-norolean-12-en-16-one (S-83)</td>
<td>-</td>
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<td>37.</td>
<td><em>Helichrysum italicum</em></td>
<td>α-amyrin (S-84) and Uvaol (S-85)</td>
<td>-</td>
<td>61</td>
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<td>38.</td>
<td><em>Aster batangensis</em></td>
<td>Asterbatanoside D and Asterbatanoside E</td>
<td>-</td>
<td>62</td>
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(S-15) \( R_1 = \text{Xyl} \quad R_2 = \text{OH} \)

(S-16) \( R_1 = \text{Xyl} \quad R_2 = \text{H} \)

(S-17) \( R_1 = \text{H} \quad R_2 = \text{OH} \)

(S-18) \( R_1 = \text{Xyl} \quad R_2 = \text{H} \)

(S-19) \( R_1 = \text{OH}, R_2 = \text{Arabinose}, R_3 = \text{H} \)

(S-20) \( R_1 = \text{H}, R_2 = \text{Arabinose}, R_3 = \text{H} \)

(S-21) \( R_1 = \text{OH}, R_2 = \text{Ac}, R_3 = \text{H} \)

(S-22)
(S-51) $R_1 = \text{[structure]}$, $R_2 = -\text{O}$, $R_3 = \text{CH}_3$

(S-52) $R_1 = \text{[structure]}$, $R_2 = \text{OH}$, $R_3 = \text{CHO}$

(S-53) $R_1 = \text{[structure]}$, $R_2 = \text{OH}$, $R_3 = \text{CHO}$

(S-54) -H
(S-55) -Ara2-1Rha
(S-56) -Ara2-1Rha4-1Xyl

(S-57)
(S-67) $R_1 = \text{CH}_2\text{OH}$, $R_2 = \text{D-Glc}$
(S-68) $R_1 = \text{CHO}$, $R_2 = \text{H}$

(S-69) $R_1 = S_1$, $R_2 = \text{H}$, $R_3 = \text{H}$, $R_4 = \text{OH}$
(S-70) $R_1 = \text{H}$, $R_2 = \text{H}$, $R_3 = \text{O-S}_2$, $R_4 = \text{OH}$
(S-71) $R_1 = S_4$, $R_2 = \text{OH}$, $R_3 = \text{H}$, $R_4 = \text{CH}_3$

(S-72) $R = S_3$
(S-73) $R = S_4$

(S-74)
(S-83) $R^1 = H, R^2 = O$

(S-84) $R = H$

(S-85) $R, R_1 = H$
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 following Compositae plants.

1. *Lactuca scariola* Linn.

2. *Xanthium strumarium* Linn.

3. *Centipeda orbicularis* Lour.

The Compositae or Astearaceae is one of the largest and most familiar families of flowering plants. Taxonomically, the family Compositae represents about 900 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.

1. *Lactuca scariola* Linn.\(^{63-65}\)

It is commonly known as ‘Kahu’ in Hindi. It is an erect glaucescent annual or biennial, about 0.3-0.9 m. high or sometimes up to 2 m. Stem simple up to the inflorescence, usually aculate-setose below, terete, striate above. Stem-leaves erect-patent, obovate-oblong, undivided, sinuate-toothed or runcinate, sagittate-amplexicaul, sessile, subentire or aculate-denticulate, 2-9 cm. long or more. Capitula 8-15 mm. long, on very short pedicels, in a cyme with spreading branches. Inner involucral bracts about 8, abortive. Flowers about 11, yellow.

**Distribution:**

It is widely distributed in W. Himalayas up to 6000-12000 ft.

**Medicinal values:**

The leaves are sweet, haematicin, hypnotic, stomachic, galactagogue; purify the blood; cure biliousness, burning sensation, headache, troubles of the nose, bronchitis and cough due to heart disease. It is also used in the treatment of scabies, leucoderma, ophthalmia, diseases of the liver.

The seeds have a strong odour and used as hypnotic, analgesic and aphrodisiac. It is also used in the treatment of headache, ophthalmia and prevent the fall of hair. Yunani system of medicine describes that the oil from the seeds has a sharp taste; good for the brain if applied to the head, the ear, or the nose; hypnotic, ahtipyretic; relieves inflammation and headache.
The fresh plant is a mild sedative, anodyne, purgative, diuretic, diaphoretic and antispasmodic. It has been found useful in the treatment of the coughs in phthisis, bronchitis, asthma and pertussis.

2. Xanthium strumarium Linn.\(^{66-68}\)

It is commonly known as ‘Chhotagokhru’ in Hindi. It is an annual, unarmmed up to 1.5 m. tall, stem short, stout, slightly branched, rough with short hairs. Leaves numerous, 5-7.5 cm. long and almost as broad as long, broadly triangular-ovate or suborbicular, acute, often 3-lobed, rough with appressed hairs on both sides, irregularly inciso-serrate, somewhat cordate and shortly cuneate at the base; petioles 2.5-7.5 cm. long, hairy. Heads in terminal and axillary racemes, the barren heads rather numerous, crowded at the top of the stem, the fertile heads fewer, axillary. Involucre of fertile heads ovoid in fruit, about 1.6 cm. long, with 2 erect mucronate beaks, pubescent, thickly clothed with usually hooked prickles, 2-called, hard and tough. Achenes 1.3 cm. long, oblong-ovoid compressed, glabrous.

**Distribution:**

It is found throughout India and Ceylon.

**Medicinal values:**

The whole plant is supposed to possess powerful diaphoretic and sedative properties. It is generally administered in the form of decoction and is said to be very efficacious in longstanding cases of malarious fever. Its root is bitter tonic and also useful in cancer and strumous diseases. Its fruits are used in small-pox. The plant has a sharp hot acrid taste; cooling, laxative, fattening, anthelmintic, alexeretic, alterative, tonic, digestive, antipyretic; improves appetite, voice, complexion, memory; cures leucoderma, biliousness, poisonous bites from insects, epilepsy, salivation, fever; good in disease of the teeth in children (Ayurveda).

3. Centipeda orbicularis Lour.\(^{69-71}\)

It is commonly known as ‘Nakchhikni’ in Hindi. It is a small annual; stems numerous, 10-20 cm. long, spreading from the root, prostrate, slender, leafy, usually glabrous. Leaves numerous, subsessile, 6-10 by 3-4.5 mm., oblong-spathulate, with few teeth, base tapering. Heads 2.5-4 mm. diam., globose, solitary, axillary, subsessile. Involucral bracts small, oblong, with membranous margins. Achenes minute, 4-angled, bristly on the angles.
**Distribution:**

It is found throughout in India in moist places and Ceylon, Afghanistan, Malaya, China, Australia and Pacific Island.

**Medicinal values:**

According to Ayurvedic system of medicine, the leaves of the plant are hot, sharp, dry, acrid; anthelmintic; appetiser; cause biliousness; cure “vata” and “kapha”, leucoderma, diseases of the blood and skin, hysteria. The leaves are stermitatory, expectorant, carminative, emetic, cathartic; enrich the blood, cure nose troubles, night blindness, sore throat, ear pain, amenorrhoea, leucoderma, scabies, ringworm, pains in the joints, hiccough, lumbago; used in ozomega, inflammations.

Earlier workers have reported several bioactive constituents from the above three plants, which are recorded in Table-II.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Plant</th>
<th>Part</th>
<th>Isolated Compounds</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>Xanthium strumarium</em></td>
<td></td>
<td>Xanthanol (S-86), Isoxanthanol (S-87) and Carboxytracynloside (S-88)</td>
<td>72-73</td>
</tr>
<tr>
<td>2.</td>
<td><em>Xanthium strumarium</em></td>
<td>Leaves</td>
<td>Xanthumin (S-89), Isohexacosane, Chlorobutanol, Stearyl alcohol, β-sitosterol, palmitic acid, Strumasterol, Oleic acid, 3,4-dihydroxyccinnamic acid, β-sitosterol-D-glucoside and KCl</td>
<td>74-76</td>
</tr>
<tr>
<td>3.</td>
<td><em>Xanthium strumarium</em></td>
<td>Roots and Stems</td>
<td>Heptacosanol, Stigmasterol, β-sitosterol and its glucoside, 3,4-dihydroxyccinnamic acid, KCl, KNO₃, K₂SO₄, stigmasterol-3-O-β-D- glucopyranoside (S-90) and 2-methylnaphthrenequinone (S-91)</td>
<td>77-78</td>
</tr>
<tr>
<td>4.</td>
<td><em>Xanthium strumarium</em></td>
<td>Aerial</td>
<td>2-Epi-Xanthumin (S-92) and 8-Epi-Xanthatine-5β-epoxide (S-93)</td>
<td>79</td>
</tr>
<tr>
<td>5.</td>
<td><em>Centipeda Orbicularis</em></td>
<td></td>
<td>Lupeol and its acetate, Hexacosanol, Stigmasterol, Centipedoic acid (S-94) and a new flavone (S-95)</td>
<td>80-81</td>
</tr>
<tr>
<td>6.</td>
<td><em>Centipeda Orbicularis</em></td>
<td></td>
<td>1β,2α,3β,19α-tetrahydroxy urs-12-ene-28-oate-3-O-β-D-Xylopyranoside (S-96) and 1β,2β,3β,19α-tetrahydroxy urs-12-ene-28-oate-3-O-β-D-Xylopyranoside (S-97)</td>
<td>82</td>
</tr>
<tr>
<td>7.</td>
<td><em>Lactuca scariola</em></td>
<td>Rhizomes</td>
<td>A new sesquiterpene lactone-8-deoxylactucin (S-98), lactupircrin, Lactucin and Jacquelinein</td>
<td>83</td>
</tr>
<tr>
<td>8.</td>
<td><em>Lactuca scariola</em></td>
<td></td>
<td>Lactuca xanthin (S-99)</td>
<td>84</td>
</tr>
</tbody>
</table>

Thus a deep sweep in the available literature reveals that there is still enough scope for further systematic phytochemical examinations of above Compositae plants.
(S-86) $R' = \text{Ac}; R = \text{H}$
(S-87) $R' = \text{H}; R = \text{Ac}$

(S-88)

(S-89)

(S-90)

(S-91)

(S-92)

(S-93)

(S-94)

(S-95)

(S-96) $R_1 = \text{H}, R_2 = \text{Me}, R_3 =$
(S-97) R\(_1\) = H, R\(_2\) = Me, R\(_3\) = \(\text{HO} - \text{H} - \text{O}\)

(S-98)

(S-99)
PROBLEM TAKEN AND WORK DONE

In recent years several 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. In India, where the medicinal flora is rich in diversity and endemism, the adequate knowledge of medicinal plants is very essential. There are a large number of medicinal plants, which have not been investigated and hence their curative values have not been recognized.

Thus there is urgent need for systematic chemical examination of those medicinal plants, which have not been studied systematically or worked at a time when modern facilities were not available for their potential therapeutic constituents. Therefore in view of the medicinal importance of Compositae plants, author took up the challenging task to examine plants (i) Lactuca scariola Linn. (ii) Xanthium strumarium Linn. and (iii) Centipeda orbicularis Lour.; with a view to isolate, purify and identify bioactive triterpenoid saponin present in them. The findings are summarized below.

CHAPTER-II

ISOLATION AND IDENTIFICATION OF A NEW BIOACTIVE TRITERPENOID SAPONIN; 3β-O-[β-D-GALACTOPYRANOSYL-(1→3)-O-β-D-XYLOPYRANOSYL-(1→4)-O-α-L-RHAMNOPYRANOSYL]-OLEAN-12-ENE-28-OIC ACID FROM THE SEEDS OF LACTUCA SCARIOLA LINN.

This chapter describes the isolation and identification of a new bioactive triterpenoid saponin from the methanol soluble part of ethanolic extract of the seeds of Lactuca scariola Linn. It was analysed for m.f. C_{47}H_{76}O_{16}, m.p. 226-228°C and [M]^+; 896 (FABMS). Its structure was identified as 3β-O-[β-D-galactopyranosyl-(1→3)-O-β-D-xylopyranosyl-(1→4)-O-α-L-rhamnopyranosyl] -olean-12-ene-28-oic acid by various colour reactions, chemical degradations and spectral data.
CHAPTER-III

ISOLATION AND CHARACTERIZATION OF A NEW ANTIIINFLAMMATORY TRITERPENOID SAPONIN; 3β-O-[α-L-
RHAMNOPYRANOSYL-(1→3)-O-β-D-XYLOPYRANOSYL]-MANILADIOL
FROM THE LEAVES OF XANTHIUM STRUMARIUM LINN.

This chapter incorporates the isolation and characterisation of a new antiinflammatory triterpenoid saponin, m.f. C_{41}H_{68}O_{10}, m.p. 254-256°C and [M]^+; 720 (FABMS) from the acetone soluble part of ethanolic extract of the leaves of Xanthium strumarium Linn. Its structure was identified as 3β-O-[α-L-
rhamnopyanosyl-(1→3)-O-β-D-xylopyranosyl]-maniladiol, by various colour reactions, chemical degradations and spectral analysis.
CHAPTER-IV

ISOLATION AND STRUCTURAL ELUCIDATION OF A NEW BIOACTIVE TRITERPENOID SAPONIN; $2\alpha,19\alpha$-DIHYDROXY-3$\beta$-O-[$\beta$-D-XYLOPYRANOSYL-(1→4)-O-$\beta$-D-GLUCOPYRANOSYL]-OLEAN-12-ENE-28-OIC ACID-28-O-$[$$\alpha$-L-ARABINOPYRANOSYL]-ESTER FROM THE LEAVES OF CENTIPEDA ORBICULARIS LOUR.

This chapter includes the isolation and structural elucidation of a new bioactive triterpenoid saponin, m.f. C$_{46}$H$_{74}$O$_{18}$, m.p. 276-278$^\circ$C and [M]$^+$; 914 (FABMS) from the methanol soluble part of ethanolic extract of the leaves of Centipeda orbicularis Lour. Its structure was established as $2\alpha,19\alpha$-dihydroxy-3$\beta$-O-[$\beta$-D-xylopyranosyl-(1→4)-O-$\beta$-D-glucopyranosyl]-olean-12-ene-28-oic acid-28-O-$[$$\alpha$-L-arabinopyranosyl]-ester by various colour reactions, chemical degradations and spectral techniques.

CHAPTER-V

ISOLATION AND STRUCTURAL STUDY OF A NEW ANTIBACTERIAL TRITERPENOID SAPONIN; 3$\beta$-O-[$\alpha$-L-RHAMNOPYRANOSYL]-30-NORolean-12,19-DIENE-28-OIC ACID-28-O-$[$$\beta$-D-GLUCOPYRANOSYL-(1→4)-O-$\beta$-D-GALACTOPYRANOSYL]-ESTER FROM THE STEMS OF LACTUCA SCARIOLA LINN.
A new antibacterial triterpenoid saponin obtained from acetone soluble fraction of ethanolic extract of the stems of *Lactuca scariola* Linn. It was analysed for m.f. C_{47}H_{74}O_{17}, m.p. 260-262°C and [M]^+: 910 (FABMS). Its structure has been characterised as 3β-O-[α-L-rhamnopyranosyl]-30-norolean-12,19-diene-28-oic acid-28-O-[β-D-glucopyranosyl-(1→4)-O-β-D-galactopyranosyl]-ester by various colour reactions, chemical degradations and spectral data.
REFERENCES


