Screening for Plant Secondary Metabolites in Selected Indigenous Herbal Plants

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Abstract: Herbal plants are differentiated by the presence and absence of certain plant secondary metabolites (PCMs). Uses of herbal plants vary with their phytochemical constituents. They may possess curative properties including anti-cancer, anti-diabetic, anti-inflammatory, anti-depressant and anti-arthritis. In this study, leaves of Gymnema sylvestre (Podapatri), Centella asiatica (Sarswathi aku), Clitoria ternatea (Sankham Poolu) and Costus igneus (Cengalva kostu) were screened for phytochemicals. Steroids, alkaloids, tannins, flavonoids and glycosides were identified in all the plant extracts while triterpenes and saponins were found in C.igneus and Centella asiatica. Anthraquinones, o-glycosides, and anthocyanidin were not identified in any of the four plants. The results indicate that the leaves of these plants are a good source of phytochemicals. Amongst the leaves C.igneus and C.asiatica have triterpenes and may have an advantage over the other two plants since triterpenes are known for their anti-inflammatory properties.

Keywords: Phytochemical screening, Plant secondary metabolites, Costus igneus, Gymnema sylvestre, Centella asiatica, Clitoria ternatea, Herbal plants, Tannins, Flavonoids.

2. Literature review

At present more than 12000 phytochemicals have been identified from plants. This includes 4000 distinct flavonoids and 600 carotenoids [3]. Phytochemicals: anthraquinones, steroids, triterpenes, alkaloids, tannins, flavonoids, glycosides, saponins, and anthocyanocides have beneficial effects on health when consumed adequately as food or medicine. The health benefits of bioactive phytochemicals are given in table 1.

Table 1. Health benefits of bioactive phytochemicals

<table>
<thead>
<tr>
<th>Phytochemical</th>
<th>Health benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthraquinones</td>
<td>Cancer preventative [4]</td>
</tr>
<tr>
<td>Steroids</td>
<td>Cholesterol lowering [5]</td>
</tr>
<tr>
<td>Triterpenes</td>
<td>Antiinflammatory [6]</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>Antitumor, antidepressant and antimalarial effect [7]</td>
</tr>
<tr>
<td>Tannins</td>
<td>Anti- carcinogenic [8]</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>Antidiabetic, anticarcinogenic, antioxidant, antiinflammatory and antiasthma [9–12]</td>
</tr>
<tr>
<td>Glycosides</td>
<td>Anticarcinogenic, anti-influenza and</td>
</tr>
</tbody>
</table>
Saponins Anti-tumor, anti-arthritis and anti-inflammatory [16–18]
Anthocyanidines Anti-inflammatory, antiosteoporosis and antiproliferative [19,20]

**Gymnema sylvestre** (cow plant) is a vine plant grows in tropical conditions. Leaf extracts of this plant are used in Ayurvedic and Homeopathic medicines for diabetes mellitus, stomachic and diuretic problem [21]. *Clitoria ternatea* commonly called as butterfly pea is a herbaceous perennial climber with deep-blue solitary flowers which grows widely in South and Southeast Asia [22]. Flower petals and leaves of this plant show medicinal properties against diabetes and inflammatory conditions [22, 23]. *Centella asiatica* is a herbaceous surface plant which shows psychotropic properties and neuroprotective potentials [24]. This plant is widely used in South and Southeast Asia for food and medicine [25]. *Costus igneus*, commonly called as 'Insulin Plant' is a well-known plant for its hypoglycemic properties. Extracts of *C. igneus* leaves have shown an increase in insulin secretion and insulin sensitivity of cells [26]. A recent study showed the presence of orally active hypoglycemic protein in *C. igneus* plant leaves [27]. Apart from its anti-diabetic activity, the plants' leaves showed anti-inflammatory, diuretic and antimicrobial properties [28]. As all the selected plants are known for their medicinal properties, they were screened to establish the presence of identified phytochemicals.

### 3. Methodology

#### 3.1 Sample preparation

Plant leaves were collected from Medicinal and Aromatic Plant Research Station, S.K.L.T.S Horticultural University, Hyderabad. Fresh whole leaves were plucked, rinsed and surface water was removed by air-drying in a hot air oven at 50° C for 30 minutes.

#### 3.2 Extraction

Extracts were prepared by macerating the leaves in chloroform, methanol, and water for fifteen minutes, shaken vigorously for 3 hours and the extracts were left to stand in the dark for 12 hrs. The macerates were centrifuged at 3000 rpm for 15 minutes to obtain clear supernatants (extracts) and stored separately for further analysis.

### 3.3 Phytochemical screening

Identification of the presence of anthraquinones, steroids, triterpenes, alkaloids, tannins, flavonoids, glycosides, saponins, anthocyanidines, and reducing sugar was conducted following the standard methods described by Harborne (1980) [29].

### 4. Results and Discussion

Screening results showed that the extracts of all the plants contained steroids, alkaloids, tannins, flavonoids and glycosides. Since tannins, alkaloids, flavonoids and glycosides have antioxidant properties these plant leaves might have anti-cancer properties as well. The presence of steroids may help in controlling CVD. Positive results for alkaloids showed that they might act as anti-depressants. However *Costus igneus* and *Centella asiatica* showed positive results to triterpenes whereas *Gymnema sylvestre* and *Clitoria ternatea* showed negative results. Therefore, the presence of triterpenes in *Costus igneus* and *Centella asiatica* leaves suggested that they might be used as a potent anti-inflammatory remedy.

**Table 2. Screening of phytochemicals in herbal plants**

<table>
<thead>
<tr>
<th>Test</th>
<th>Costus igneus</th>
<th>Centella asiatica</th>
<th>Clitoria ternatea</th>
<th>Gymnema Sylvestre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthraquinones</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Bontranger's reagent</td>
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<td>--</td>
<td>--</td>
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<tr>
<td>Modified</td>
<td>--</td>
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<td>--</td>
</tr>
<tr>
<td>Bontranger's reagent</td>
<td>++</td>
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</tr>
<tr>
<td>Steroids</td>
<td>++</td>
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<tr>
<td>Salkowski test</td>
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<tr>
<td>Lieberman test</td>
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<td>++</td>
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<tr>
<td>Tschugajen test</td>
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<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>++</td>
<td>++</td>
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<td>++</td>
</tr>
<tr>
<td>Wagner's test</td>
<td>++</td>
<td>++</td>
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<tr>
<td>Hagger's test</td>
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<td>++</td>
</tr>
<tr>
<td>Dragedoff's test</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
</tbody>
</table>
Tannin
Ferric Chloride
test  ++  ++  ++  ++

Flavonoids
Ferric Chloride
test  ++  ++  ++  ++
Lead acetate test  ++  ++  ++  ++

Glycosides
Sodium
hydroxide test  ++  ++  ++  ++
Keller kili
anis test  ++  ++  --  --
O-Glycosides  --  --  --  --

Saponin
Foam test  ++  --  --  ++

Anthocyanoside  --  --  --  --

Reducing sugar
Fehling's
Reagent  ++  ++  ++  ++

‘++’ = Present, ‘--’ = Absent

5. Conclusion

Potentials of herbal plants to cure diseases depends on its phytochemical composition. Screening of Gymnema sylvestre, Centella asiatica, Clitoria ternatea and Costus igneus for their phytochemical constituents showed that they are a good source of phytochemicals which may have anti-cancer, anti-diabetic, anti-inflammatory, anti-depressant and anti-arthritis properties. Costus igneus and Centella asiatica with the presence of triterpenes may have anti-inflammatory advantages over other two herbal plants. Based on the phytochemical constituents further studies of isolation and evaluation of individual compounds from these plant leaves can give an insight into their curative properties against various lifestyle related diseases.

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