SUMMARY
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'The thesis entitled Biological and Phytochemical Investigation of some Indian Traditional Plant Medicines and their Formulations' embodies the work on the Biological studies of the crude extracts of Abutilon indicum, Hygrophila spinosa and Smilax china and Phytochemical examination of Abutilon indicum, Hygrophila spinosa and the isolation and characterization of various phytoconstituents. This has been presented in three chapters and a chapter wise summary is given below.

CHAPTER-1: Introduction

This chapter comprises of an introduction to plants as source of drugs, some important secondary metabolites used as drugs and a review of literature on Abutilon indicum, Hygrophila spinosa and Smilax china comprising of biological studies and phytochemicals isolated so far reported. This chapter also includes the scope and objective of the present study.

CHAPTER-2
Part-1: Anti-inflammatory activity

In this chapter the detailed methodology available to test the anti-inflammatory activity is discussed. The studies on anti-inflammatory activity of roots of Abutilon indicum, Hygrophila spinosa and Smilax china are recorded. Carrageenan induced oedema model was used to assess anti-inflammatory activity of alcohol extracts of Abutilon indicum, Hygrophila spinosa and Smilax china. The paw oedema was measured by Zeitlins apparatus. To assess the validity of the method a known anti-inflammatory agent diclofenac sodium (5mg/kg) was administered orally to one group as the standard drug. Roots of Abutilon indicum, Hygrophila spinosa and Smilax china methonolic extract produced significant reduction in paw oedema at all the treated doses (50, 100, 200mg/ml) which are comparable with that of standard drug diclofenac sodium. The effects produced by the extracts is dose dependent. The results were given in Table-2,3,4 and Fig.-1,2,3,4,5,6. Bioflavonoid or steroids or saponins contain herbal drugs are known to produce anti-inflammatory action.
The herbal formulation developed also showed significant anti-inflammatory activity when compared with the commercial herbal formulation Table-9 and Fig.-7,8. For the first time the author has prepared a poly herbal formulation with all the three plant species. The results obtained were quite significant as its effect matched almost all with that of commercial herbal formulation.

Part-2: antihepatotoxic activity

Interaction with the tribes of Visakhapatnam district revealed the roots of *Abutilon indicum*, *Hygrophila spinosa* and *Smilax china* were used to cure jaundice. During the literature survey on these plants the author has come across that only *Abutilon indicum*, *Hygrophila spinosa* said to have antihepatoprotective activity. Therefore the author was interested in screening methanolic extracts of roots of *Abutilon indicum*, *Hygrophila spinosa* and *Smilax china* for antihepatotoxic activity against carbon tetrachloride (ccl₄) induced liver damage in albino rats to assess the folkloric claims.

Serum levels of SGOT, SGPT, SALKP and total bilirubin were significantly increased (p<0.001) in carbon tetra chloride treated Group-11 rats. Group -III rats treated with Silymarin produced significant reduction (p<0.001) in SGOT, SGPT, SALKP and total bilirubin.

In Groups IV-VI treated with methanolic extract of *Abutilon indicum* at doses of 50,100,200mg/kg p.o respectively, there is significant decrease in SGOT, SGPT, SALKP and total bilirubin when compared to Group-II rats. The activity of the extract is found to be dose dependent. The results were given in Table-1 and Fig.-1.

In the same way Group VII-IX were treated with methanolic extract of *Hygrophila spinosa* at doses of 50,100,200mg/kg p.o respectively. This extract too showed significant reduction in SGOT, SGPT, SALKP and total bilirubin when compared to Group-II rats. The results were given in Table-2 and Fig-2. In Groups X-XII, treated with methanolic extract of *Smilax china* at doses of 50,100,200mg/kg p.o respectively there is significant decrease in SGOT, SGPT, SALKP and total bilirubin when compared to Group-II rats. Like *Abutilon indicum* and *Hygrophila spinosa*, the activity of *Smilax china*
also found to be dose dependent. The results were given in Table-3 and Fig.-4.

Pretreated with Silymarin (standard) and methanolic extracts of roots have produced significant antihepatotoxic activity.

For the first time the author has proved that Smilax china roots have exhibited significant antihepatotoxic activity. However the antihepatotoxic responsible chemical constituents have to be isolated and also the mechanism of action of has to be ascertained.

For the first time the author has prepared a poly herbal formulation with all the three plant species. The results obtained were quit significant as its effect were comparable with that of commercial herbal formulation. Table-9 and Fig.-4.

Part-3: Antidiabetic activity

This chapter discussed about antidiabetic activity. The antidiabetic activity of roots of Abutilon indicum, Hygrophila spinosa and Smilax china are recorded. The extracts of Abutilon indicum, Hygrophila spinosa and Smilax china were studied against alloxan induced diabetic rats. The rats are divided into 21 groups, and each group consists of 5 rats. Groups ii- iv, viii-x and xiv-xvi were treated with extracts of Abutilon indicum, Hygrophila spinosa and Smilax china respectively at doses of 50, 100, 200mg/kg in each group. Where as groups v-vii, xi-xiii and xvii-xix were treated with alloxan induced diabetic rats are treated with extracts of Abutilon indicum, Hygrophila spinosa and Smilax china. Group's xx and xxi, normal and alloxan induced diabetic rats respectively are treated with the standard drug tolbutamide at a dose of 20mg/kg. The extracts Abutilon indicum, Hygrophila spinosa and Smilax china at all doses exhibited promising, potent and statistically significant percent decrease in blood glucose. From the results it was found that all the three extracts found to have hypoglycemic and antidiabetic activity. All the three extracts exhibited the percent reduction in blood glucose from 2nd hour and gradually increased to the maximum reduction level at 6th hour.

For the first time the author has prepared poly herbal formulation with all the plant species. The results obtained were quit significant as its effect
matched almost all with that of commercial herbal formulation. Results were given in Table-6,7,8,9,10,11,14 and Figures-1,2,3,4,5,6,7,8,9,10,11 and 12.

Part-4: Antimicrobial activity

The plant extracts were screened for antimicrobial activity against various bacteria and fungal strains. Antimicrobial screening of the plant extracts was carried out by cup plate method.

All the extracts at a concentration of 250ug and 500ug per each cup exhibited antibacterial and antifungal activities (Table-1 and 2) against one or the other organisms in dose dependent manner.

These results are in close agreement with that of the previously reported antimicrobial and antifungal activities for Abutilon indicum and Smilax china. The author is the first to report the antibacterial and antifungal activities for Hygrophila spinosa. However the chemical constituents isolated from Abutilon indicum and Hygrophila spinosa have to be tested for antimicrobial and antifungal activities.

CHAPTER-3: Phytochemical examination

This chapter discussed about phytochemical examination of Abutilon indicum, Hygrophila spinosa but not Smilax china due to the dearth of the extract.

A careful study of the literature available revealed that not much phytochemical work was carried out on the roots of Abutilon indicum and Hygrophila spinosa. In view of the prevalent use mentioned by the folklore in the treatment of inflammation and liver disorders and also due to the little phytochemical work reported, a systematic approach was followed to isolate chemical constituents from roots of both the plants.

Shade dried powdered roots of Abutilon indicum and Hygrophila spinosa were separately extracted in a soxhlet apparatus for 6 hours successively with chloroform and methanol and concentrated to dryness under vacuum.

For column chromatography the chloroform extract of Abutilon indicum was taken on column chromatography over silica gel yielded two compounds, AIC-1 and AIC-2. The compounds were characterized on the basis of their
UV, IR, $^1$H NMR, $^{13}$C NMR and Mass spectral data in the sequence as follows.

<table>
<thead>
<tr>
<th>S.no.</th>
<th>Compound</th>
<th>molecular formula</th>
<th>m.p (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AIC-1 lupeol</td>
<td>$C_{30}H_{50}O$</td>
<td>195-196</td>
</tr>
<tr>
<td>2</td>
<td>AIC-2 5,7-dihydroxy 6-methyl C, $C_{16}H_{12}O_5$</td>
<td>204-205</td>
<td></td>
</tr>
</tbody>
</table>

Compound AIC-2 is reported for the first time from the roots of *Abutilon indicum*.

For column chromatography the methanolic extract of *Abutilon indicum* was taken on column chromatography over silica gel yielded two compounds, AIM-1 and AIM-2. The compounds were characterized on the basis of their UV, IR, $^1$H NMR, $^{13}$C NMR and Mass spectral data in the sequence as follows.

<table>
<thead>
<tr>
<th>S.no.</th>
<th>Compound</th>
<th>molecular formula</th>
<th>m.p (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AIM-1 B-sitosterol</td>
<td>$C_{36}H_{54}O_2$</td>
<td>136-138</td>
</tr>
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</table>
For the column chromatography, the methanolic and chloroform extracts of *Hygrophila spinosa* were mixed because of less extract obtained with chloroform HSR-1 and HSR-2. The two compounds obtained were characterized on the basis of their UV, IR, $^1$H NMR, $^{13}$C NMR and Mass spectral data in the sequence as follows.

<table>
<thead>
<tr>
<th>S.no.</th>
<th>Compound Code</th>
<th>Code name</th>
<th>molecular formula</th>
<th>m.p.(°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HSR-1</td>
<td>lupeol</td>
<td>C$<em>{30}$H$</em>{50}$O</td>
<td>195-196</td>
</tr>
<tr>
<td>2</td>
<td>HSR-2</td>
<td>BA-Amyrin</td>
<td>C$<em>{16}$H$</em>{12}$O$_{5}$</td>
<td>199-200</td>
</tr>
</tbody>
</table>

The compound first time reported, AIC-2 is not obtained in sufficient quantity therefore biological activities could not be carried out.

Any conclusion?

Integrate your results