Chapter 7

SUMMARY, CONCLUSION
AND RECOMMENDATIONS
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To present succinctly, it can be stated that the present investigation was carried out pharmacognostic, phytochemical and pharmacological properties to ascertain the ethanobotanical claims of pharmacological potentials of the leaves of Flemingia chappar and bark of Gyrocarpus asiaticus.

Levels of macronutrients and heavy metals like magnesium, arsenic, potassium, sodium, mercury and palladium in the FCE and GAE were analyzed by Plasma Optical Emission Spectrophotometer and Atomic Absorption Spectroscopy. The results suggest that the levels were found to be within allowable limits of pharmacopoeia, hence suitable for internal administration. The results of the toxicity studies (acute and subacute) as per OECD Guidelines 420 and 435 confirmed it as category 5 as it has not shown symptoms and toxicity.

Phytochemical studies of FCE showed the presence of carbohydrates, flavanoids, proteins, steroids and tannins. Alkaloids, flavanoids, triterpenoids, tannins, phenolics, carbohydrates and proteins were found to be present in GAE.

A small quantity of unsaponifiable matter of FCE and GAE was subjected chromatographic separation by the solvent system of ethanol and chloroform in the proportion of 0.2:9.8. The developed chromatograms yielded four and three spots respectively. Column chromatography with gradient elution technique was conducted using
hexane, chloroform, and methanol. Thin layer Chromatography was used to monitor the eluates. A total of 158 eluates were collected and similar fractions were and similar fractions were pooled and mixed together. Further purification was carried out by preparative TLC using chloroform: ethanol (9.8:0.2) as solvent.

The isolated compounds were subjected to different spectral studies such as IR, $^1$H NMR (400MHz), $^{13}$C NMR (100MHz) and GC-MS to ascertain the chemical structure. The IR spectrum was recorded on FTIR, $^1$H-NMR and $^{13}$C-NMR spectra were recorded using CDCl$_3$ as solvent and GC-MS spectra were recorded at high resolution on a mass spectrometer and the data are given in m/z values.

Compound 1, **FCE$_1$**, a white powder with MP 136-140°C and MW 414.71 at 25°C was found to be 17-(5-Ethyl-6-methylheptan-2-yl)-10,13-dimethyl-2,3,4,7,8,9,11,12, 14,15, 16,17-dodecahydro-1H-cyclopenta [a] phenanthren-3-ol i.e. **β-Sitosterol** (C$_{29}$H$_{50}$O).

Compound 2, **FCE$_2$**, an yellow to greenish yellow crystalline powder with MP 316°C, and MW 302.236 was found to be 2-(3,4-dihydroxyphenyl)-3,5,7-thihydroxy-4H-chromen-4-one i.e. **Quercetin** (C$_{15}$H$_{10}$O$_7$).

Compound 3, **FCE$_3$**, yellow powder with MP 260-265°C and MW 284.26 was found to be 5,7-dihydroxy-2-(4-methoxyphenyl) chromen-4-one, i.e. **Acacetin** (C$_{16}$H$_{12}$O$_5$).
Compound 4, **FCE**₄, a Pale-Yellow Crystalline Solid, with M.P. 242°C (468°F; 515 K) and MW 610.52 was found to be 2-(3,4-dihydroxyphenyl)-5,7-dihydroxy-3-[4-L-rhamnopyranosyl-(1→6)-β-D-glucopyranosyloxy]-4H-chromen-4-one i.e. **Rutin** (C_{27}H_{30}O_{16})

Compound 5, **GAE**₁, a white powder with M.P. 160 to 164°C (320 to 327°F; 433 to 437 K) and MW 355.428 was found to be (13aS)-2,3,9,10-tetramethoxy-6,8,13,13a-tetrahydro-5H-isoquinolinol[2,1-b]isoquinoline i.e. **Tetrahydropalmatine** (C_{21}H_{25}NO_{4})

Compound 6, **GAE**₂, a white powder with M.P. 165-167°C and MW 412.69 was found to be (13aS)-2,3,9,10-tetramethoxy-6,8,13,13a-tetrahydro-5H-isoquinolinol[2,1-b]isoquinoline i.e. **Stigmasterol** (C_{29}H_{48}O)

Compound 7, **GAE**₃, a yellow crystalline solid with M.P. 276-278°C and MW 286.23 was found to be 3,5,7-Trihydroxy-2-(4-hydroxyphenyl)-4H-chromen-4-one i.e. **Kaempferol** (C_{15}H_{10}O_{6})

Hepatoprotective activity studies were done with the tested extracts using N-acetyl-1-cysteine and Silymarin as standard drugs on CCl₄ and paracetamol models and the efficacy of tested extracts was noticed. Antidiabetic efficiency of the test extracts were done alloxan and streptozotocin induced diabetic rats using Glibenclamide as standard. Analgesic activity studies of the tested extracts conducted by five different methods showed effective and dose dependent efficacy. Anti-inflammatory studies of the test extracts on
carrageenan, dextran, histamine and cotton pellets induced models showed effective and dose dependent efficacy. The extracts also reduced elevated body temperatures showing excellent antipyretic activity in the yeast induced pyrexia model.

**Recommendations:**

The drug discovery from plants is multi-disciplinary as well as inter-disciplinary. It commences with a botanist, ethanobotanist, ethanopharmacologist, plant ecologist who collect and identified the plants of interest. Phytomics is the new discipline where the primary and secondary metabolites of plants such as flavanoids, phenols, lignins, sterols, alkaloids, and terpenoids, including moss, algae, ferns and fungi are studied.

Herbal medicine has been the integral part of the culture and civilization. In modern society, herbal medicine based on the heritage continues to play an indispensable role in the current healthcare and well-being of millions of people. As per the WHO publication in the year 1994, 90% of the world’s population use medicinal plants for curing and 81% have no access to synthetic drugs. Traditional or complementary medicine has seen an upsurge in recent years and is evident that 48.5% Australian and 34% of American respondents have used at least one form of unconventional therapy including herbal medicine.
In the modern scenario, phytochemistry based research is attracting more attention of the pharmaceutical industry, as Scientists are aware that herbs have almost infinite resources for development of medicines.

The seven compound isolated were found to be present in appreciable amounts hence responsible for the biological actions studied. Additional effort at molecular level is essential to find out the exact mechanism of action for all therapeutic actions of the plant extracts and isolated compounds.