CHAPTER-6

SUMMARY AND

CONCLUSION
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*Cichorium intybus* Linn., family Asteraceae, is commonly known as chicory and used in Indian System of Medicine as cardiotonic, anti-inflammatory, digestive, stomachic, liver tonic and diuretic. *C. intybus* is also used extensively in coffee blends as a vegetable and in value-added healthcare products. The present study was an attempt in the direction of standardizing the leaves, stems and roots of *C. intybus*, characterization of phytoconstituents isolated from roots and the useful utilization of different extracts of leaves, roots and compounds isolated from roots as hepatoprotective drug.

In the present investigation an attempt has been made for the first time to standardize leaves, stems and roots of *C. intybus*. The studies on the standardization parameters of all three parts indicated a marked difference in the values obtained in all the experiments. Botanical evaluation and physico-chemical parameters will give an idea about the quality of the drug.

Phytochemical screening indicates presence of secondary metabolites. HPTLC fingerprint profile of all three parts was studied. Petroleum ether, chloroform, acetone and ethanol extracts shown 5, 16, 15 and 17 no. of spots (for leaves), 2, 13, 17 and 16 spots (for stem) and 5, 13, 15 and 26 spots (for roots), respectively with different Rf values in different solvent systems. The derivatization of plates were done with anisaldehyde in sulphuric acid and scanned at 254 and 366 nm. Heavy metals (lead, cadmium, chromium, nickel, arsenic and mercury) were found within the prescribed limits.

Quantitative determination of total phenolic content in the hydroalcoholic stem extract was found to be higher (0.100 mg/gm) than the alcoholic leaf extract (0.074 mg/gm) and alcoholic root extract (0.048 mg/g), total flavonoid content in the hydroalcoholic leaf extract was found to be higher (16.20 mg/gm) than the alcoholic extracts of stem (3.45 mg/gm) and root (0.40 mg/g), total resin content in leaves was found to be higher (2.53 mg/gm) than stems (2.46 mg/gm) and roots (1.75 mg/gm). The umbelliferone content in the methanolic extract of stems (10 μl) was found to be higher (0.3318 g/ml) than the methanolic extracts of leaves (0.1337 g/ml) and roots (0.1337 g/ml). The esculetin content in the methanolic extract of leaves (10 μl) was found to be higher (0.0000281 g/ml) than...
the methanolic extract of roots (0.000014 g/ml), esculetin also present in the stems but in negligible amount. These parameters will help to link the purity analysis and botanical identity to the chemical constituent profile of the plant. HPTLC profile of the drug will serve as a reference for quick quality control approval of the drug.

The new phytoconstituents; Lup-12,20(29)-dien-3β-ol-3α-D-arabinofuranosyl-5′-hexadecanoate (CI-1), Lup-12,20(29)-dien-3β-olyl hexadecanoate (CI-2), Stigmasta-5,22-dien-3β,7-diol-3-o-hexadec-7-enoate (CI-3), Stigmasta-5,22-dien-3β-ol-26-oic acid (CI-4), Stigmasta-5,22-dien-3β-ol-21-oic acid (CI-5) were isolated from the roots for the first time will help in assigning the crude drug a new chemical marker.

The alcoholic, hydroalcoholic and aqueous extracts of leaves, roots (at the dose of 200 and 400 mg/kg p.o.) and compound CI-3 and CI-4 isolated from the roots of C. intybus (at the dose of 25 mg/kg p.o.) have been evaluated for their in vivo hepatoprotective activity against thioacetamide (100 mg/kg s.c.) a hepatotoxin. Activity was performed on Wistar albino rats by estimated different biochemical parameters like SGOT, SGPT, total protein, total and direct Bilirubin, alkaline phosphatase in serum and the results obtained were supported by the histopathological studies of the liver tissues. All the extracts of leaves, roots and isolated compounds CI-3, CI-4 were compared with each other on the basis of the biochemical parameters and histopathological studies. It was concluded that
aqueous extract of roots (400 mg/kg) was shown significant results as compared to different extracts of leaves and roots; isolated compound CI-4 showed potent hepatoprotective activity as compared to that of silymarin. The hepatoprotective activity may be due to the presence of flavonoids and triterpenoids in the crude drug.

Further it is suggested that the aqueous extract of roots and CI-4 (stigmasta-5,22-dien-3β-ol-26-oic acid) isolated from the roots by column chromatography showing significant hepatoprotective activity compared to that of silymarin, can be developed in to a potent hepatoprotective herbal formulations.

Botanical evaluation and physico-chemical parameters will give an idea about the quality of the drug. The standardization parameters can be used for the standardization and evaluation of crude drugs or their formulations. Our study validates the use of C. intybus in various polyherbal formulations like Liv-52, Acilvan, Hepex, Livokin and Vimliv etc.

We suggest that more elaborated standardization procedures can be undertaken using sophisticated instrumentation techniques. Other frequently used hepatoprotective plants should also be screened for their activity. Attempt should also be made to the use of C. intybus along with other established hepatoprotective drugs and omitting the useless ingredients of polyherbal formulations.