

6: SUMMARY AND CONCLUSION:

Cancer is characterized by uncontrolled growth of cells which arise from various sources like chemical mutagens and changing lifestyles in day to day life. Millions of lives have been known to be taken worldwide by different forms of cancer due to insufficient apoptosis or ineffective therapies. Till now many researcher has been undergoing from many disciplines to find an effective therapy of cancer. Earlier chemoprevention with synthetic drugs have been undertaken for the treatment of cancer however due to the development of secondary cancers with such treatment, scientist have started using alternative options to reduce the side effects of chemoprevention. This can be done only with the help of natural products obtained from plants. Medicinal plants are the rich source of secondary metabolites that can reduce the side effects of free radicals generated from the treatment of various diseases including cancer. The free electrons or hydrogen present in the structural compositions of the compounds of secondary metabolites help in the donation to the free radicals thereby normalizing the harmful effects. Before it can be made usable to the human beings, it is an important task to test the medicinal plants in the laboratory using various test models, test methods which are relevant to human beings. From such experiments we can find out the useful properties possessed by the medicinal plants.

Curcuma caesia Roxb, also known as black turmeric is a perennial herb with bluish black rhizomes and is native of East and Central India. The plant has many medicinal properties and has been practiced by many ethnic communities of North East India. The present study investigates the antimutagenic and antigentoxic activity of *Curcuma caesia* Roxb against the antineoplastic agent cyclophosphamide (indirect acting mutagen) so that it can be helpful in generating the strong biochemical foundation to

confirm it as a good source of medicinal properties that can suppress the side effects caused by cyclophosphamide.

Briefly the results obtained can be summarized as follows:

- Preliminary phytochemical screening of the rhizomes of the medicinal plants confirms the presence of various secondary metabolites such as alkaloids, steroids, flavanoids, terpenes, phenolics, carbohydrates, reducing sugars, tannins, saponins. The bioactivities shown by the different extracts of the rhizome of the said plant may be due to the action of single or combined action of these compounds.
- Phenol content was found to be remarkable and was found to be higher in the ethanolic extracts amongst all the extracts. Total phenolic contents in the examined plant extracts ranged from 4.82 to 68.64 mg GAE/ d.wt of the extract. Total phenolic content of EECC, MECC, EaECC and AECC are found to be 68.64, 52.11, 38.0 and 4.82mg GAE/ g d.wt. Reducing power assay was also found to be more in EECC extract which was followed by other extracts. The presence of phenolic compounds might be the reason behind the bioactivities of the extracts.
- All the extracts EaECC, EECC, MECC and AECC have shown a quite significant scavenging activities against the free radicals DPPH, ABTS⁺ and O₂⁻ which was clear from the ability of the extracts to donate electrons/ hydrogen to scavenge free radicals. It was found that EECC have highest electron donation capacity towards DPPH while EaECC had highest electron donation capacity towards ABTS⁺ and O₂⁻ radicals. It indicates that the number and positions of phenols present in extracts does not depend upon the scavenging activity of the extracts against ABTS⁺. Also the scavenging of superoxide anions was found to be highly exhibited by EaECC followed by other extracts.
- All the four extracts have shown significant inhibitory effect against the indirect acting mutagen cyclophosphamide in TA 98 and TA 100 strains of Salmonella auxotrophic mutants. The antimutagenic effects were

found to be more pronounced in the co-incubation treatment that could be related to bioantimutagenic nature of extracts or fractions. This might led to the defense mechanisms of all the extracts against the mutagenesis caused by indirect acting mutagen.

- In acute toxicity test, there were no signs of toxicity during the period of investigation. CCEs was well tolerated upto 2000mg/kg.b.wt with no adverse effects. There was no sign of change in the behaviour, skin and fur color, no salivation, diarrhea, lethargy, tremors, sleep as well as coma in the studied animals.
- Genotoxicity studies give ideas on deleterious actions on the integrity of cells genetic materials and it was performed by employing micronucleus test. The three extracts EaECC, MECC and EECC exhibited antigenotoxic activity against the genotoxicity caused by the indirect acting mutagen cyclophosphamide significantly which was indicated by the decrease in the number of micronuclei formation through micronucleus assay.
- All the animals were examined for their biochemical properties such as SGOT, SGPT, lipid peroxidation, GSH levels, GR levels as well as protein levels in both the kidney and liver. SGOT, SGPT and lipid peroxidation was found to be increase in the CP treated groups however the pretreatment of extracts at different concentrations decreases the level of SGOT, SGPT and lipid peroxidation levels. On the other hand, GSH, GR and protein levels were found to be decreased by the treatment of CP and it was again increased by the pretreatment of the extracts. It indicates the hepatoprotective, nephroprotective activity of the extracts tested against the hepatotoxicity, nephrototoxicity caused by the side effects of the administration of cyclophosphamide drugs.
- Morphological destructions of the liver and kidney cells caused by the side effects of cyclophosphamide administration were found to be altered with the prior administrations of all the three extracts which were

shown clearly by the regeneration of the morphology of the liver and kidney in the histopathological analysis.

- It has also been found that the cytotoxicity of the three extracts EaECC, EECC and MECC against the cancer cell lines MDAMB 231(breast cancer) and lung cancer Calu6 was found to be significant.
- GC-MS analysis of EaECC and EECC showed the presence of 29 and 44 compounds respectively. The peaks present in the GC chromatogram were matched with the NIST library and were found to present terpenes as the major compounds in both the extracts and contain many other compounds. May be because of the presence of terpenes as the major compounds, the extracts have shown the antimutagenic and antigenotoxic activity of the extracts was shown in the present investigations.
- UV-Visible spectroscopy of EaECC and EECC also shown the presence of peaks where the flavanoids lies in between. The presence of flavanoids also supports the anyimutagenic and antigenotoxic activity of the rhizomes of *Curcuma caesia* Roxb against the indirect acting mutagen cyclophosphamide.

However, an analysis of the results suggested that although the extracts and different fractions of *Curcuma caesia* Roxb exhibited protective activities through various assays, the most appropriate use of the plant will depend ultimately on understanding the brief mechanisms of action, in molecular, tissue/cell levels or whole body of the animals to be studied. So there is urgent need of evaluating the extracts at all levels to extend the work.