

Abstract

The present study was carried out to investigate the ethnopharmacological effects of the essential oils, extracted from different parts of some members of family Rutaceae. Moreover, the oils were characterized and used as an instrument for designing keys to genus, species and variety of the plants. As far the chemical composition of oils was concerned, Monoterpenes dominated in the essential oils of all the plants, followed by sesquiterpenes, alcohols, Ketones and then phenols. Diterpenes were found in essential oils from *Murraya paniculata* cv. desi and *M. paniculata* cv. China, *Citrus reticulata* cv. Honey and *Boenninghausinia albiflora*. Alcohols were met within essential oils from *Skimmia laureola*, *M. paniculata* cv. Desi and *M. paniculata* cv. China, *C. reticulata* cv. Honey, *B. albiflora* and *Zanthoxylum armatum*. Esters were found in the oils of *S. laureola*, *M. paniculata* cv. Desi and *M. paniculata* cv. China, *Aegle marmelos* and *B. albiflora*. Ketone in *S. laureola*, *C. reticulata*, *B. albiflora* and *Z. armatum*. Phenols were present in *M. koenigii* and *C. reticulata*. Hydrocarbons in *S. laureola*, *M. koenigii*, *M. paniculata* cv. Desi and *M. paniculata* cv. China, *A. marmelos* and *B. albiflora*, Oxygenated Sesquiterpenes, aldehyde and Limonene derivatives were only present in *B. albiflora*, while Oxygenated ester *S. laureola* and Carboxylic acid in *C. reticulata*. Essential oils from *Zanthoxylum armatum* leaves and seeds had Ketones and monoterpenes respectively. The presence of ketones in oils from leaves made it best suitable insecticide. Two cultivars of *Murraya paniculata*, recognized in horticulture viz; Desi and China considered morphological different due to local environmental variations showed considerable difference in the composition of their essential oils, thus paving the way for using this chemotaxonomic character as their distinction marker. The essential oils showed high total phenolic and flavonoid contents in terms of GAE and TFC values, which was indicative of their high antioxidant and radical scavenging capacities. A relatively good relationship between was found between TPC and

antioxidant activity determined through ABTS radical cation decolorization assay and FRAP Assay. The essential oils samples had considerable resistance to lipid peroxidation, which was quite comparable with that of trolox (10 μ M), the standard antioxidant. The percent superoxide anion radical scavenging activity was found to be in highest range of 56.6 to the lowest, 2.5 percent for essential oils from *Skimmia laureola* stem and *Aegle marmelos* rind respectively. The FRAP values were found to be in highest range of 22.13 to the lowest, 0.094 mM FeSO₄ for *Aegle marmelos* leaves and *Zanthoxylum armatum* leaves respectively. The metal chelating activity was noticed to be in the highest range of 81.45 and to lowest 16.96 for *Murraya koenigii* leaves and *Murraya paniculata* cv. China respectively. Hence the data presented here showed that all samples of essential oils had high antioxidant and radical scavenging activity and thus may be used as a good source of natural antioxidants. All essential oils of different plant parts included in this study also showed anthelmintic activity but with variations in them. As per LC₅₀ value the most potent essential oil was from parts of *Zanthoxylum armatum* and *Skimmia laureola* while least potent from parts of *Citrus reticulata* and *Boenninghausinia albiflora*. Similarly a dose dependant effect of each essential oil indicated that essential oils from parts of *Zanthoxylum armatum* and *Skimmia laureola* took minimum time to kill all worms. The essential oils proved to be more effective than the standard anthelmintic drug, levamisole, used as positive control thus qualifying to be used as replacement of the synthetic anthelmintics. All essential oils showed appreciable insecticidal and repellent effects, e.g. essential oil from *Skimmia laureola* leaves, showed highest repellent effect followed by oil from root and stem of *Boenninghausinia albiflora*. The lowest repellent activity was exhibited by essential oils from *Zanthoxylum armatum* seeds and rind of *Citrus reticulata* cv. Honey. Dose dependant effect indicated that the most potent insecticidal activity was shown by the essential oil from leaves of *Murraya paniculata* cv. China and *M. koenigii*. The excellent repellent effect of essential oils proved their promising commercial prospects as insect formulations. All the essential

oils exhibited effective antimicrobial activity and having zones of inhibition (ZI) higher than the standard antibiotic and antifungal against all test microbes, e.g. essential oil from *Murraya paniculata* cv. and Desi and *Skimmia laureola* stem having maximum from *Boenninghausinia albiflora*, *Citrus reticulata* leaves, *Murraya paniculata* cv. Desi leaves having least antimicrobial activity. Hepatoprotective activity was also observed, with best results by essential oils from *M. paniculata* cv. China leaves, *B. albiflora* roots, *Skimmia laureola* leaves, roots, stem and *Zanthoxylum armatum* stem. A very encouraging aspect in this activity was that these oils not only proved hepatoprotective but also hepatoregenerative as well. Moreover, the hepatoprotective activity of most of the essential oils not only comparable but even better than that of Silymarin, the standard antidiabetic drug used. Antidiabetic activity was also exhibited, with best results by essential oils from leaves of *Citrus reticulata* followed by leaves *Murraya paniculata* cv. Desi and *M. paniculata* cv. China and *M. koenigii*. Mostly high concentrations of essential oils showed hypoglaecemic effect. Essential oils from different parts of *Zanthoxylum armatum* did not show any antidiabetic activity. Moreover, the antidiabetic potential of essential oils from different parts of *B. albiflora* and different species of *Murraya* tested in this study, was comparable with that of Glibenclamide, the standard antidiabetic drug used. The patch test was employed to determine the possible "irritant contact dermatitis" (ICD) potential of essential oils. Essential oils from different parts of *B. albiflora* showed maximum skin irritation as compared to the essential oils from *M. koenigii* and *Z. armatum* leaves exhibiting minimum. Gender based results showed interesting variations, e.g. females showing more positive results than the males. Essential oils extracted for study were found of variety of chemical components. Among these, Limonene, β -cymene, Undecanol, Glycedol are some important irritant chemicals. An attempt was made to use the chemical components for identification of the plants used. Already existing keys based on morphological characters were strengthened with the help of

chemical components present in essential oils of these plants. Cluster analyses helped to identify differences at genus, species and variety levels. This was indicative of the fact that chemical constituents can be used as tool for identification and classification of the plants thus opening ways for chemotaxonomy. In the present study classes of compounds and chemical compounds were used as basis of cluster analysis and successful segregation of the genera, species and varieties was achieved.

Finally it can be concluded that essential oils tested in this study were having ethnopharmacological importance. These essential oils can replace the existing synthetic chemicals / drugs to cure various human ailments as well as of domestic animals. At the same time it can safely be said that essential oils can also be used to solve, the still unresolved, puzzles of evolutionary taxonomy thus opening boulevards for chemotaxonomy.