CHAPTER - 9

Chemotaxonomy through Antioxidant activity of Essential oil

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9.1. INTRODUCTION

An essential oil is an aromatic product and usually has complex composition. In connection with their multifarious composition, the range of biological functions of this oil is wide (Burger & Wachter 1998). For external application, they are therapeutically used as spasmolytic, anti-inflammatory, anodyne, antiviral, antibacterial and anti-mycotic activities (Chaudhry & Tariq 2006). Internally they are usually handled as capsule; and also as tablet, sugar-coated tablet, suppository, spirituous extract, unguent or even pure oils themselves (Hamid *et al.* 2011). These oils are not only used medicinally, but also as perfumery agent and frequently applicable as fragrance for aromatherapy (Edris & Abd El-Galeel 2010).

Lauraceae is an oil yielding family (Li *et al.* 2008b), and the examination of the essential oil content of different species was continued. The essential oil of two genera viz. *Cinnamomum* and *Litsea*, which are commonly available plants of Terai and Duars region of West Bengal were used as food preservatives, folk remedy to treat several diseases, disorders and ailments (Geiger 2005; Senhaji *et al.* 2007). Since long time, essential oil of *Cinnamomum* has been used to treat gastritis, dyspepsia, blood circulation disturbance and inflammatory disorders in many countries (Wang *et al.* 2009). Also, they showed potential antipyretic, analgesic, anti-allergenic, antitussive (Gurdip *et al.* 2008) and chemo-preventive activities (Sabulal *et al.* 2007). Therefore, the aim of this study was to isolate the essential oil from the bark of eight available species of Laurels and evaluate antioxidant properties of these essential oils obtained from two genera, *viz. Cinnamomum and Litsea*. The antioxidant activity can also be examined as a tool for chemotaxonomy for clustering these plants. For the said purpose, the free-radical scavenging data obtained from mature barks of these two genera were used for Hierarchical Clustering through correlation co-efficient matrix for determining the relationships among these plants.

9.2. RESULT AND DISCUSSIONS

Natural products are in growing demand from the manufacturers of pharmaceuticals, cosmetics and food additives to consumers using these products. Thus the importance of conducting works on essential oils lies not only in the chemical characterization but also in the possibility of making meaningful relation among different species of economically important families through particular bioactive functional properties.

Figure 9.1- 9.6 showed the capacity of antioxidant activity of the eight Laurels of Terai and Duars region. DPPH is a compound that has been generally used to test the free radical-scavenging capacity of various samples. Figure 9.1 depicts the free scavenging activity of eight essential oils on DPPH radicals at various concentrations. Essential oils of *Litsea assamica* demonstrated the highest inhibitory activity compared to other antioxidants studied. But in case of superoxide anion scavenging, nitric oxide scavenging, metal chelating capacity of those species *Cinnamomum tamala*,

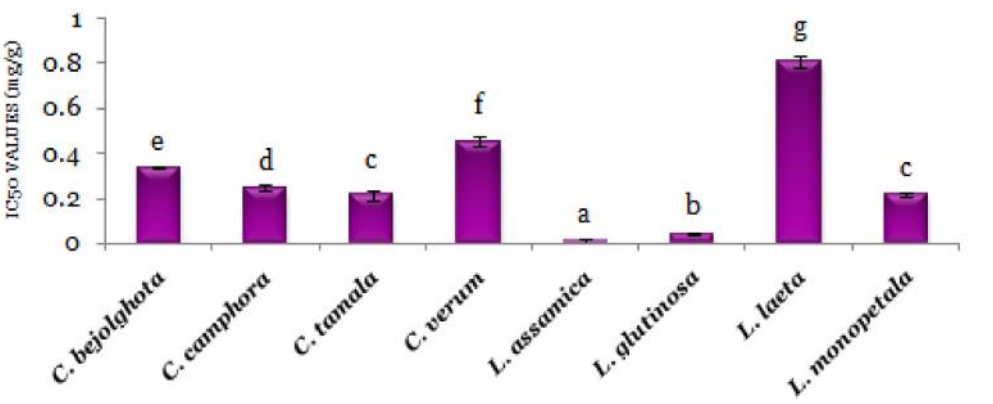

Figure 9.1. DPPH scavenging activity of essential oils of studied taxa

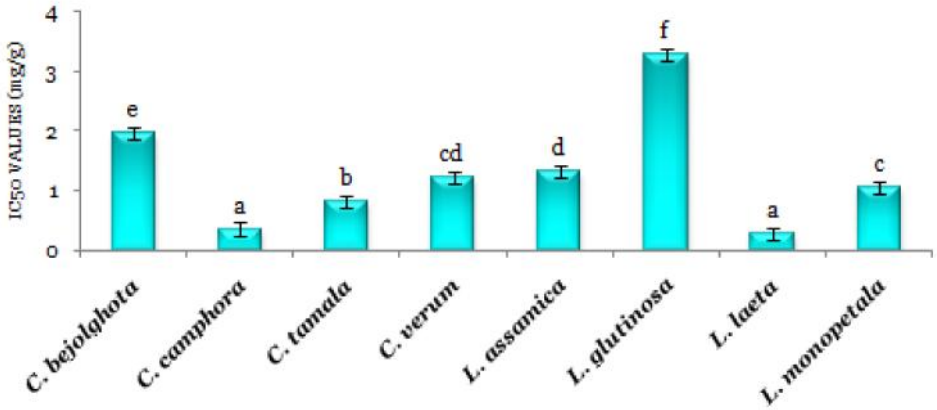

Figure 9.2. Superoxide radical scavenging activity of essential oils of studied taxa

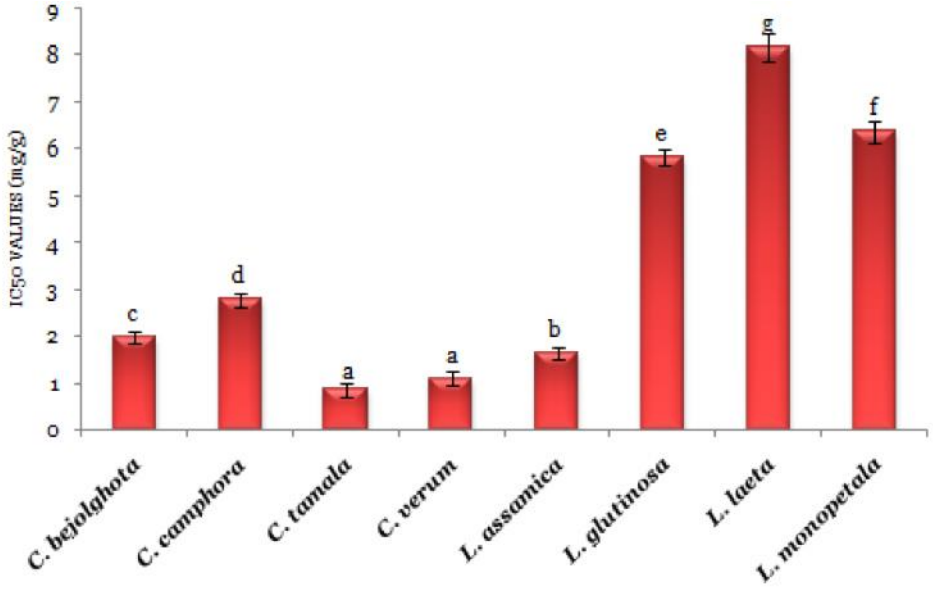

Figure 9.3. Nitric oxide scavenging activity of essential oils of studied taxa

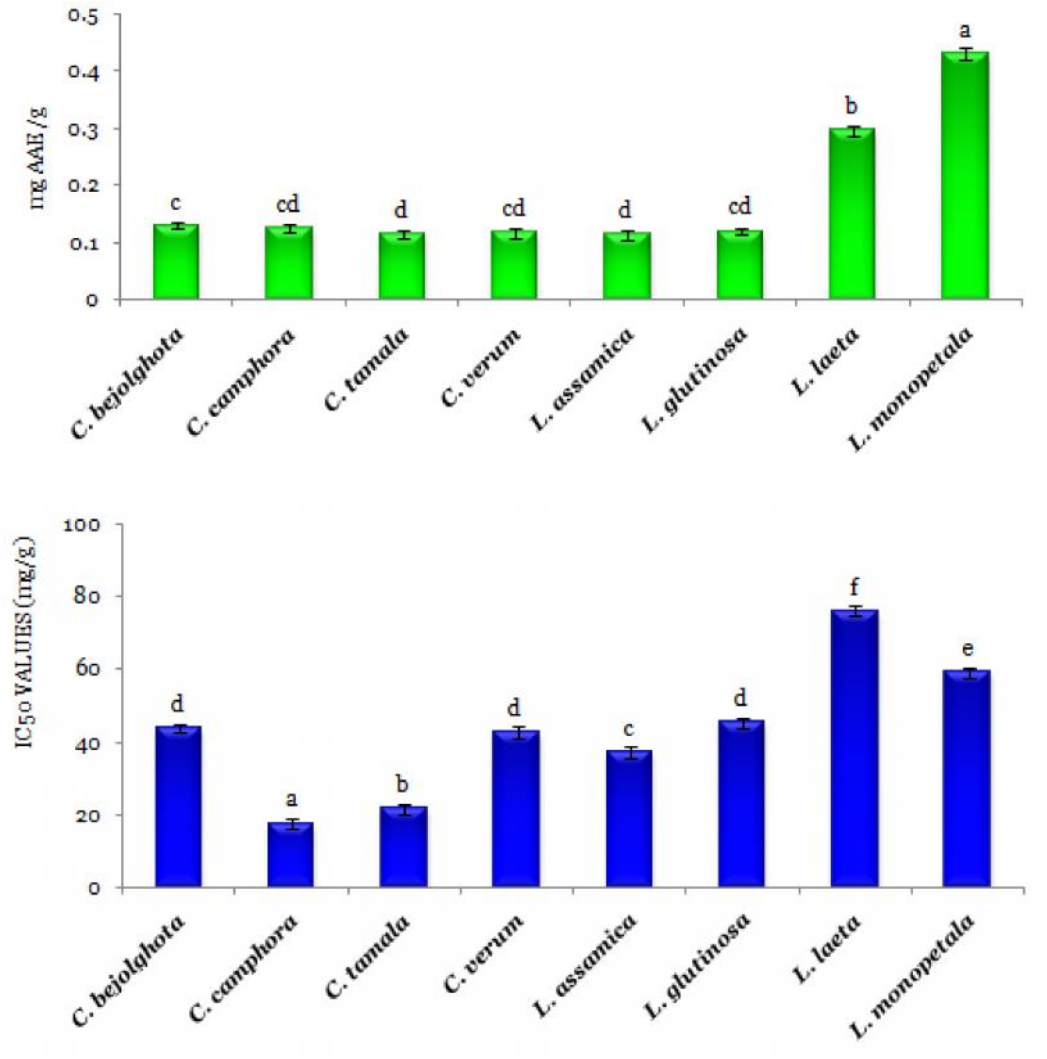

Figure 9.5. Metal chelating activity of essential oils of studied taxa

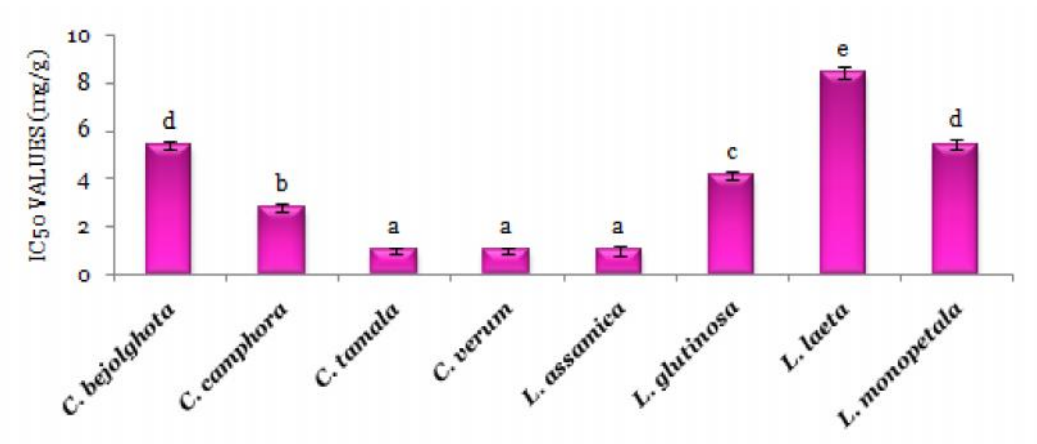

Figure 9.6. Anti-lipid peroxidation activity of essential oils of studied taxa

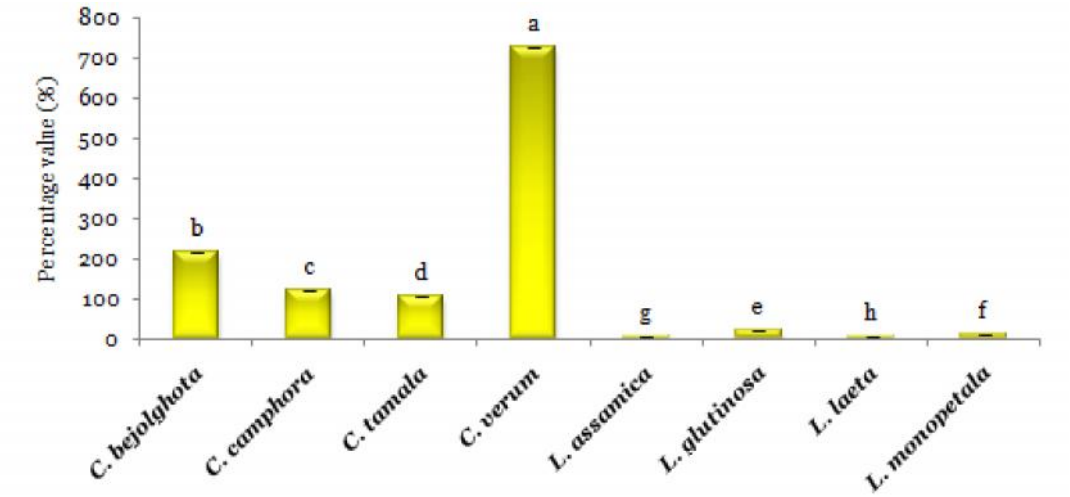

Figure 9.7. Extractive values of essential oils of studied taxa

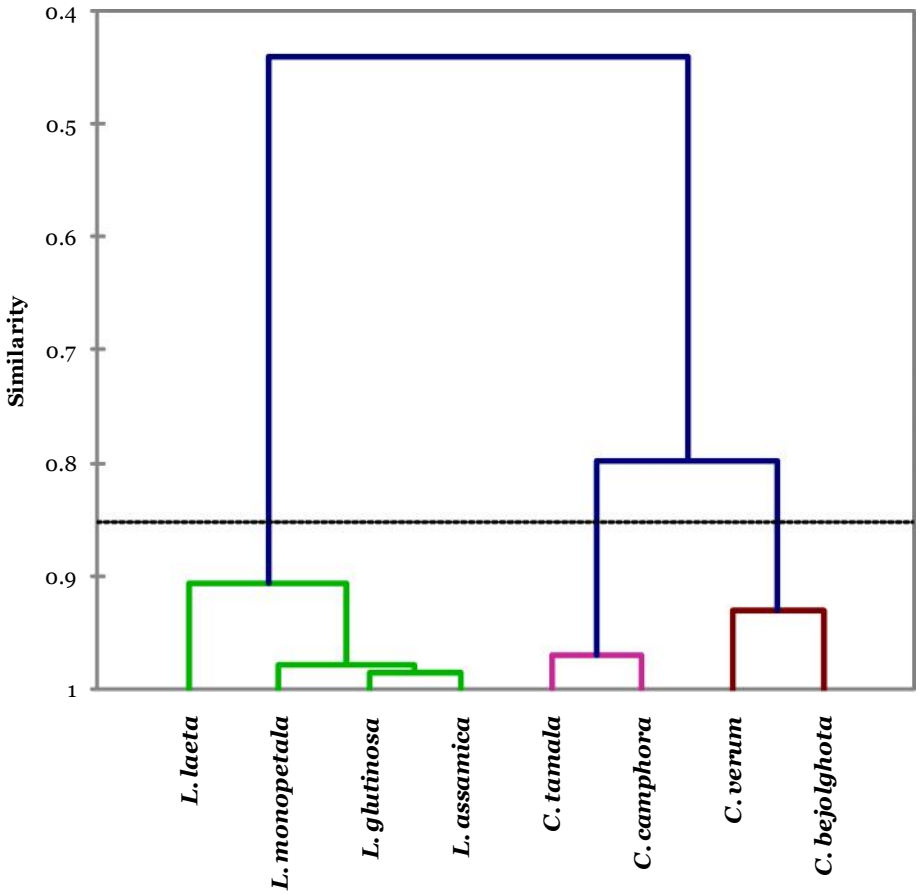

Figure 9.8. Cladistic approach of eight Laurels on the basis of antioxidant activity of their essential oils extracted from bark

C. verum and *C. camphora* showed higher activity than *Litsea* species (Figure 9.2-9.4). Another activity like reducing power is highest in *L. monopetala,* whereas antilipid peroxidation is just like DPPH scavenging capacity in Laurels.

Table 9.1. Correlation matrix analysis of different free-radical scavenging potential of essential oil obtained from studied taxa

	EV	DPPH	SO	NO	RP	MC
DPPH	0.250					
SO	-0.019	-0.530				
NO	-0.518	0.390	0.010			
RP	-0.343	0.334	-0.303	**0.728***		
MC	-0.152	0.591	0.011	**0.789***	0.698	
ALP	-0.409	0.595	-0.051	**0.849****	0.646	**0.793***

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

The extractive yields of different essential oils of eight Laurels were presented in Figure 9.7. Relatively higher extraction yields were obtained from *Cinnamomum* than *Litsea.* The highest extraction yield was found in the dichloromethane extract from the bark of *C. verum* with 725.9%, while the oil of *L. laeta* (4.2%) had the lowest extraction yield. *Cinnamomum* oil has also noticeable higher antioxidant activity towards the free radicals confirmed by the lowest IC_{50} value. The results were parallel to the outcome of the Schmidt *et al.* (2006) works. They worked with *C. verum* and claimed the tremendous effective antioxidant capacity of the oil of that plant. The essential oil of all plants in our work demonstrated high chelation activity with respect to Fe^{3+}, resulting in a prevention of hydroxyl radicals' initiation. The oil inhibited effectively conjugated diene formation as well as the formation of secondary products from lipid peroxidation. In 2010, Joshi *et al.* investigated the antioxidant activity of seven Laurels of Himalaya. They also confirmed the significant lipid peroxidation capacity of those plants of that region.

The table 9.1 showed the correlation matrix of essential oils of different Laurels based on antioxidant activities. The table represented that nitric oxide scavenging capacity is highly correlated with reducing power, metal chelating capacity and antilipid peroxidation activity. On the other hand, metal chelating capacity is well correlated with antilipid peroxidation.

When comparing the eight Laurels with the cladogram based on the antioxidant profile (Figure 9.8), it was found that *Litsea* genus is separated from the genus *Cinnamomum*, which corresponds the similar grouping developed by the morphological characteristics (Chapter-5). In the cladogram the two species of *Litsea* like *L. assamica* and *L. glutinosa* are present in same clade and appear to be much related with *L. monopetala* than *L. laeta*. Next in the cladogram, *C. verum* and *C. bejolghota* was branched from same clade and these are the representatives with higher free radical scavenging property. Finally, we see another clade with *C. camphora* and *C. tamala*

which are not phytochemically very similar but when the functional attributes of essential oils are considered, they exhibited similar trend like morphological clustering. Overall it might be considered that different species of *Cinnamomum* differ markedly from the representatives of *Litsea* in terms of antioxidant properties and quantitative existence of bioactive phytochemicals in their essential oils as reflected in present dendrogram (Figure 9.8).

From numerous other studies, it is evident that the chemotaxonomic studies based on the average or absolute concentration of functional phytochemicals present in numerous predefined taxa would not yield reliable results might be due to differential accumulation of secondary metabolites and functional alteration of related genes under changing environmental perspectives. Moreover, the predefined compounds cannot signify the overall chemical information, and some predefined compounds also may not be ideal chemotaxonomic markers. Thus, the fingerprint-based data were used in the next chapter.