

**CHAPTER 6: CONCLUSION**

Two species of medicinal plants, namely *Ervatamia coronaria* and *Tinospora crispa* were investigated for their chemical constituents, antioxidant and antimicrobial properties. TLC analysis revealed the presence of secondary metabolite such as alkaloid, terpenoid, flavanoid, phenol, saponin and conjugated bond compound.

Total phenolic content assay of these plants revealed that chloroform and methanol extracts contain higher phenolic content compared to petroleum ether and water extracts. It supports the findings of antioxidant assays where *Ervatamia coronaria* exhibited pronounced antioxidant properties in DPPH Radical Scavenging Assay, Reducing Power Assay and Haemolysate Catalytic Assay especially by chloroform and methanol extracts except for Metal Chelating Assay for *Ervatamia coronaria* (roots) where water extract exhibited pronounced antioxidant activity. Meanwhile, methanol extract of *Tinospora crispa* exhibited pronounced antioxidant activity in all four assays. Based on statistical analysis of correlation, significant positive correlation was observed in DPPH Assay and Reducing Power Assay while weak correlation or no significant difference between Total Phenolic Content and Metal Chelating Assay and Haemolysate Catalytic Assay.

*Ervatamia coronaria* and *Tinospora crispa* can be considered for the treatment of sinusitis because they have the ability to inhibit and kill (cidal) the common microorganism causing sinusitis such as *Haemophilus influenza*, *Streptococcus pneumoniae*, *Moraxella catarrhalis* and *Staphylococcus aureus*. Preliminary screening of antimicrobial activity of *Ervatamia coronaria* and *Tinospora crispa* against 10 microorganism causing sinusitis showed all the extracts can inhibit to at least one of the microorganisms except for

*Tinospora crispa* (stems) water extract which cannot inhibit any of the microorganisms. Inhibition of microorganisms by these extracts increased with increasing concentrations. The lowest Minimal Inhibitory Concentration (3.12 mg/ml) were observed on chloroform extract of *Ervatamia coronaria* (stems) against *Moraxella catarrhalis*, methanol extract of *Tinospora crispa* against *Streptococcus pneumoniae* and petroleum ether extract of *Tinospora crispa* against *Staphylococcus aureus*. Only certain extracts can kill (cidal) the microorganisms based on Minimal Bactericidal Concentration (MBC) assay although they can inhibit the microorganisms.

Initial investigation using LCMS/MS analysis showed that all sample extracts contain high amounts of alkaloids, thereby affirming results obtained from Thin Layer Chromatography (TLC). The mass fragmentations of the compounds were based on journal references and ACD/Labs advanced chemometrics mass fragmentations predictive software but further confirmation of the compound detected can be done using reference standards or complimentary data from various analytical instrumentations. The presence of secondary metabolites like phenolic compound such as flavonoids in the plant extract may be responsible for antioxidant activity and presence of major group antimicrobial compounds such as alkaloids, terpenoids and phenolic compound could be responsible for antimicrobial activity.

Further studies are needed to isolate and identify the active principles with antioxidant and antimicrobial activity as well as to evaluate the possible synergism among extract components. The present results also offer a scientific basis for traditional use of both plants on treatment of sinusitis. Findings of this study indeed justified the potential of

*Tinospora crispa* and *Ervatamia coronaria* as source of antioxidant agents by preventing damage and subsequent inflammation to healthy tissue such as the sinus by free radicals and also as source of antimicrobial agents against bacteria that cause sinusitis. But *in vivo* studies on these medicinal plants are necessary in order to determine toxicity of the active constituents, their side-effects and diffusion in different body sites.