6. SUMMARY AND CONCLUSION

Traditionally used medicinal plants produce a variety of compounds of known therapeutic properties. The substances that can either inhibit the growth of pathogens or kill them and have no or least toxicity to host cells are considered candidates for developing new antibacterial drugs. In recent years, antibacterial properties of medicinal plants are being increasingly reported from different parts of the world. It is expected that plant extracts showing target sites other than those used by antibiotics will be active against drug resistant microbial pathogens. However, very little information is available on such activity of medicinal plants. Hence, the present study, aimed at screening selected plants for their anti-bacterial activity and evaluating their potential use in treating infections caused by multidrug resistant \textit{S. pneumoniae}. From the present investigation, following observation were made.

- Seven hundred salivary samples were collected from infected patients at various places from Tamil Nadu. Out of 700 subjects enrolled in this study, 140 analyzed salivary samples showed positive result for Streptococcal infection.

- Morphology, Biochemical test for oral samples performed to screened the Streptococci strain. (In Streptococci strain, \textit{S. pneumoniae} showed gram staining. Methyl red, sugar production and bile solubility were positive and similarly vogesproskur, Citrate utilisation were negative).

- Virulence factors were detected through protease, phospholipase and slime test. Strong slime production was found in two strains; higher protease (13 mm) was found in S2 and S3 strains; positive phospholipase activity were identified in 4 isolates of \textit{S. pneumoniae}.

- Nucleotide sequences of multiple resistances \textit{S. pneumoniae} were confirmed by 16S r DNA sequencing with universal bacterial primers (16S-UP-F, UP-R) which was deposited in Gene Bank (Accession Number JQ247720), and phylogenetic tree was constructed.
Phytochemical studies showed the presence of alkaloids, carbohydrates, proteins, saponins, phytosterols, phenols, flavonoids, and terpenoids, in *A. cepa, A. sativum* and *F. bengalensis*. Tannins are absent in *A. cepa, F. bengalensis*. Whereas pholobatannin was absent in *A. cepa, A. sativum*.

GC-MS analysis revealed the occurrence of 40 bioactive compounds in *A. cepa*, 31 in *A. sativum* and 18 in *F. bengalensis*.

Out of 40 bioactive compounds identified in *A. cepa*, 2-Furancarboxaldehyde, 5-(hydroxymethyl), 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl, Maltol, 1,2,3-Propanetriol, 1-acetate were screened for anti-bacterial activity.

In the case of *A. sativum*, among 31 compounds, only 3 compounds such as Sucrose, Urs-12-en-3-ol, acetate, (3â€‹â€‹)â€‹, 12-Oleanen-3-yl acetate, (3â€‹â€‹)â€‹, were detected to show anti-bacterial activity.

Out of 18 bioactive compounds from *F. bengalensis*, only 3 compounds like Oxalic acid, 2-ethylhexyl ethyl ester, 1,2-Benzenediol, Dodecanoic acid were identified for anti-bacterial activity.

Anti-Bacterial activities were exhibited by individual and combined solvent fractions of *A. cepa, A. sativum* and *F. bengalensis*. Among the three plants combined fraction of *A. cepa* showed maximum zone of inhibition against *S. pneumoniae* and further proved by minimum antibacterial concentration.

From the molecular docking, among the anti bacterial bioactive compounds Urs-12-en-3-ol, acetate, (3â€‹)â€‹ alone was found to be more efficient (â€‹â€‹199.02) against Nan A enzymes.

This Urs-12-en-3-ol, acetate, (3â€‹)â€‹ could be used against multiple resistance *S. pneumoniae*. 

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The more effective bioactive compound Urs-12-en-3-ol, acetate, (3α) was found in *A. sativum* only, not in *A. cepa* and *F. bengalensis*. Therefore, it is suggested that *A. sativum* and could be the source for treatment of Streptococcal infection.

From the above results it is concluded that *A. sativum* has great potential to use a new phytomedicine against multiple resistant *S. pneumoniae*. Therefore selected compounds from these plants could be utilized by the pharmacological society for the development of novel drugs against streptococcal infection. Since our country is a rich source of the medicinal plants, used in this day, development of these phytomedicine is relatively inexpensive and less time consuming.