Bio-augmentative antibacterial activity of *Pongamia pinnata* (L.) gall extract with lemongrass oil formulation against selected Gram-negative bacteria

B. K. Chithra[1], P. P. Anand[2,*], E. Pushpalatha[3,*], Y. Shibu Vardhanan[2] and K. P. Mohammed Shareef[1]

[1]Department of Zoology, Pocker Sahib Memorial Orphanage College, Tirurangadi 676 306, India
[2]Biochemistry and Toxicology Division, and
[3]Biopesticide and Toxicology Division, Department of Zoology, University of Calicut, Thenhipalam 673 635, India

The present study evaluates the antimicrobial activity of ethanolic and aqueous extract of *Pongamia pinnata* (L.) normal leaves, gall-removed leaves and galls. They were tested against five Gram-negative human pathogenic bacterial strains: all strains have unique antimicrobial resistance and pathogenic properties. Among the different extracts, ethanolic gall extract exhibited a broad spectrum of antimicrobial activities. Based on this feature, we augmented the ethanolic gall extract with lemongrass oil, which produced higher antimicrobial effects than ethanolic gall extracts. The ethanolic gall extracts containing several bioactive metabolites that exhibited a different level of biological activities were validated using the prediction of activity spectra for substances (PASS) server (*in silico* approach). Using the plant parts, especially galls, to prepare antibacterial agents not only helps to control pathogenic strains of bacteria, but also reduces the wastage of *P. pinnata* leaves when used for Ayurvedic preparations. Also, it help to reduce the dependence on synthetic antimicrobial drugs.

Keywords: Antibacterial activity, bioaugmentation, micro-titre plate bioassay, *Pongamia pinnata* leaf gall.

South East Asia and Malaysia. In the Ayurvedic literature of India, different parts of the plant have been recorded as a remedy for various diseases[8–12]. The chemical examination of various parts of the plant also has been reported[13]. The seeds and seed oils have been used for treating various inflammatory and infectious diseases[14]. The secondary metabolites of the plant are mainly responsible for their antimicrobial activity[2].

Galls are described as abnormal growth of plant tissues caused by the increase of some plant growth hormones like auxin, cytokinin, gibberellins, etc. under the influence of parasitic organisms. *Aceria pongamiae* K. is a highly host-specific eriophyid mite-producing finger-like leaf galls on *P. pinnata*[15–17]. Eriophyid mites induce diverse forms of abnormalities like blisters, galls, etc. Gall ontogeny is a set of complex interactions between the cells of plants and organisms that cause the formation of gall[18]. Since the leaves of *P. pinnata* are used to prepare Ayurvedic medicines, the galled leaves are considered waste or remain unused. This study intends to use the antibacterial ability of galls against pathogenic micro-organisms. Our study aims to evaluate the comparative antib[illegible]