ETHNOPHARMACOLOGY
Recent Advances

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The present volume is a compilation of selected lectures presented in the 4th National Conference of the National Society of Ethnopharmacology and the International Conference on Ethnopharmacology and Alternative Medicine organized jointly by Amala Cancer Research Centre, Thrissur, Kerala, India and the National Society of Ethnopharmacology. This conference was meticulously planned and organized by the faculty and students of Amala Cancer Research Centre. We, therefore, express our sincere thanks to Rev. Fr. George Pius, Managing Director, Amala Hospital and Research Centre, and Amala Institute of Medical Sciences for his help, support and encouragements. We are also grateful to Rev. Fr. Gabriel, Founder Director, Amala Hospital and Research Centre for his blessings and Rev. Fr. Francies Kurissery, Rev. Fr. Sales, Rev. Fr. Deljo Puthoor for their support and Dr. Ramadasan Kuttan, Research Director, Amala Cancer Research Centre for his cooperation. We have great pleasure to acknowledge the whole hearted involvement of Dr. T.A. Ajith and B. Nitha, C.R. Meera, Thulasi G. Pillai, Mathew John, V.R. Vineesh, P.V. Fijesh and other research students in the successful conduct of the conference.

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Editors
Preface

Ever since Efron et al. introduced the term Ethnopharmacology in 1967, this new branch of Science has grown into a vibrant and dynamic scientific discipline during the past four decades. Ethnopharmacology as defined by Bruhn and Holmstedt (1981) is ‘the interdisciplinary scientific exploration of biologically active agents traditionally employed or observed by man’. All ancient cultures and civilizations developed and fostered their own therapeutic systems, making use of the locally available bioresources and inorganic materials, through empirical observations and inference. They also attempted to provide rational explanations and interpretations to the prophylactic and curative properties of the drugs employed by them. Over the millennia, the accumulated knowledge were codified and edited into excellent treatises which has come down to us as the authoritative texts of the classical systems of medicine such as Ayurveda, Siddha, Unani, Amchi and the Chinese, Egyptian and Greek systems of medicine. Parallel to these classical systems of medicine which were mainly accessible to the urban elite and the nobility, the common village and tribal folks maintained a living, vibrant and down to earth healing art, transmitted to succeeding generations through the oral tradition.

Traditional medicines, both classical and oral, possess the advantage of having time tested remedies whose efficacy has been established by empirical observations. Ethnopharmacological research is chiefly targeted on traditionally used formulations and their ingredients. Ethnomedical knowledge which is normally community based, location specific or sometimes family based or individualized is a valuable resource base for ethnopharmacological investigations. Having realized the intrinsic value of traditional knowledge on plants used for food and medicine by various cultures, there has been a growing interest in the scientific community engaged in bioprospecting for drug development to gain access to this valuable knowledge base. This was further quickened by the fact that several laboratories from around the world reported a higher positive hit rate in their screening programmes, when they selected the target plants on the basis of their use in traditional medicine. As a result
the positive hit rate of 0.001 normally obtained in most of the laboratories on random screening was substantially raised to a thousand fold on traditional knowledge based screening. This has considerably reduced the cost of screening resulting in saving of resources and manpower.

Having realized the immense value of traditional knowledge on plants used for food and medicine, several nations have brought in legislation for protection of such knowledge base, especially in the current IPR regime, conferring ownership rights to communities, societies and nations with a view to safeguard the interest of the custodians of traditional knowledge.

The great progress and impact that ethnopharmacological research has brought to mankind can be gauged by the number of novel bioactive molecules discovered from traditionally used medicinal and animal products. A few noteworthy examples are the discovery of artemisinin from *Artemisia annua*, quinine from *Cinchona* bark, vincristine and vinblastine from *Catharanthus roseus*, morphine from *Papaver somniferum* etc. Ethnopharmacologic research thus aims at scientific validation of traditional knowledge and development of new useful products through science and technology intervention.

The National Society of Ethnopharmacology established in a meeting of like minded people held in 1986 at Regional Research Laboratory, Jammu, has been in the forefront for promoting ethnopharmacological research in academic institutions and in research laboratories. Today several universities and research institutions are conducting M. Phil. and Ph. D. programmes in ethnopharmacology. The Society has organised four National Seminars and one International Seminar during the past 20 years. The Society has over 100 life members besides ordinary and student members. The Society has conferred Fellowships on 15 distinguished Scientists in recognition of their significant contribution for the advancement of ethnopharmacology. The book ‘Glimpses of Ethnopharmacology’ published by the Society was widely acclaimed by the Reviewers and the Scientific Communities. The present Volume is the second in the series. We hope this compilation will be welcomed by all those who are interested in the study and research in ethnopharmacology.

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Mechanisms of Apoptosis Induced by Garlic-Derived Components

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ABSTRACT
The anticancer properties of garlic have been recognized for centuries and organosulfur compounds of garlic are believed to account for these properties. Major organosulfur compounds derived from garlic include allicin, ajoene, diallyl sulfide (DAS), diallyl disulfide (DADS) and diallyl trisulfide (DATS). We found that allicin inhibited the growth of cancer cells of murine and human origin. Allicin induced the formation of apoptotic bodies and a typical DNA ladder in cancer cells. Furthermore, activation of caspases-3,–8, and–9 and cleavage of poly (ADP-ribose) polymerase were induced by allicin. Our results provide a mechanistic basis for the antiproliferative effects of allicin and partly account for the chemopreventive action of garlic extracts. To understand the antiproliferative and apoptotic effects of allicin metabolites such as DAS, DADS and DATS, cancer cells of diverse origin were treated with these drugs at various concentrations for a fixed time interval. DAS, DADS and DATS were shown to inhibit the proliferation of these cell lines in a cell type specific manner. DAS, DADS and DATS treated cells were analyzed for their effects on the regulation of key proteins that are involved in apoptosis such as p53 and Bax. Further studies are needed to understand the mechanisms of apoptosis induced by garlic components.

Introduction
Garlic (Allium sativum), a member of the Liliaceae family, is one of the earliest documented plants for its varied uses and texts of ancient times endorsed its usage in

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