

Invited Commentary

Ethnopharmacology and phytomedicine

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20th century witnessed a paradigm shift in the driving force of the world from the traditional military power to the industrial and financial powers. In the 21st century, we are witnessing yet another revolutionary driving force, 'the knowledge'. The 21st century will be a 'century of knowledge... and a nation's ability to convert knowledge into wealth and social good through the process of innovation will determine its future (Mashelkar, 2001). A new thinking centered on the concept of knowledge engineering for building up future 'knowledge societies' and 'knowledge industries' is gaining attention and acceptance both nationally and internationally. Four technologies; namely Biotechnology (BT), Information Technology, Herbal Technology and Nanotechnology are going to be the most powerful instruments of the 21st century that would control the world trade and economy. Generating new knowledge and converting it into useful products, processes and services using the latest advances made in S&T, and subsequent transfer of such products and technologies to industry and commerce with appropriate safeguards of IPR protections are some of the key strategies that countries like India should focus on to achieve economic prosperity and sustainable development.

The promotive, preventive and corrective approach of health prevalent in the traditional medicine (TM) of India and China are now being widely appreciated and getting increasing recognition in the world over. Besides being the mainstay of health care of over 80% of the world population, TM, particularly those of India and China is looked upon as a source for developing effective therapeutic agents to many degenerative and gerontological disabilities and metabolic disorders for which there is no cure or satisfactory management available in modern medicine. 'Rasayana' and 'Panchakarma' method of treatment of Ayurveda are the two important treatment regime attaining greater appreciation and acceptance in this context.

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The holistic approach of Indian system of medicine (ISM) as well as Chinese system which internalizes all aspects of human health and diseases, is perhaps the greatest contribution of Indian and Chinese medicine. It is the whole human being, not merely the disease entity, that forms the focal point of management and treatment in the classical systems of medicine. However, due to certain historical reasons, these traditions began to decline. Orthodoxy, dogmatism, and superstitions have crept in and that affected adversely further growth and development of the ISM in India and other Asian countries. These systems have failed to adopt and assimilate the fast developments that were happening in modern biological and physical sciences. It has also confronted with problems of establishing appropriate references for fixing the standards and specifications of identity, purity, strength, and good manufacturing practices. Efforts to revive and revitalize the traditional systems of medicine, thereby providing a sound scientific based system are yielding encouraging results.

Over the last decade, WHO's Health Assembly has passed a number of resolutions in response to the resurgence in the study and use of traditional medicine and health care and in recognition of the importance of medicinal plants to the health systems of many developing countries. It is now well accepted that the herbal remedies practiced by traditional communities the world over are perfected by people by trial or error or by clinical experimentation over hundreds and thousands of years and are still in vogue for taking care of the common ailments. **Recognizing this intrinsic value of traditional medicine, WHO (1977) urged the nations to utilize their traditional systems of medicine (resolution WHA 3049). In 1978, it called for a comprehensive approach to the subject of medicinal plants (resolution WHA 331.33).**

- An inventory and therapeutic classification, periodically updated of medicinal plants used in different countries.
- Scientific criteria and methods for assessing the safety of medicinal plant products and their efficacy in the treatment of specific conditions and diseases.
- International standards and specification for identity, purity, strength and manufacturing practices.

- **Methods for safe and effective use of medicinal plant products by various levels of heal the workers.**
- Dissemination of such information among member states; and
- Designation of research and training centres for the study of medicinal plants.

The efficacy of many traditional remedies are no longer questioned. But the risk of using certain poisonous plants in various traditional systems of medicine without proper processing/detoxification still continues. The manufacturing of herbal drugs should, therefore, be governed by the same standards of safety and efficacy as are required for modern pharmaceutical products. Proof of safety should take precedence over establishing efficacy, and accuracy in labelling the constituent of medicinal plant remedies is critical for safety evaluation and drug control. Where safe and simple medicinal plant remedies have been employed traditionally for a long time in the treatment of minor self-limiting conditions, establishing verification of efficacy may not be so important, provided their composition is known.

Resource base of all traditional medicines is mainly the plants and animals. Animal products and minerals also find applications in some of these traditional medicines. The unique geographic position of India, as a meeting place of the three major biogeographic zones, offering diverse ecoclimatic and edaphic conditions afforded diverse ecosystems ranging from the humid tropics of the Western Ghats to the alpine zones of Himalayas, from the dry deserts of Rajasthan to the tidal mangroves of the Sunderbans. Although the number of flowering plants reported so far are only **17000**, the intraspecific variations and the habitat diversity that accommodate them, make India one of the richest medicinal plant genetic resource centres of the world. Out of these plants, Ayurveda use about 800 plants in its various formulations. Siddha system use about 600 plants, Unani about 600 plants and Amchi and Tibetan together make use of about 700 plants. Thus, the total number of plants used in these classical systems of traditional medicine is about 2000 species. Apart from these classical traditions, the rich and varied oral and other folk traditions use a large number of wild plants for medicine. According to an All India Survey, conducted by the All India Co-ordinated Research Project on Ethnobiology (AICRPE) during the last two decades among the tribal communities of India, about 8000 plants are used by these communities for medicinal purpose (Pushpangadan, 1998).

The centuries old traditional wisdom on therapy has been declining sharply across the globe since the spread of modern medicine and other codified systems. This decline has resulted in the loss of knowledge on use of many important plant species and techniques of preparing various traditional formulations. Plants form one of the major ingredients in

these oral medicinal systems. India has over 550 tribal communities who live in the forest areas of mountainous regions or islands of the country living close to nature. These people have an intimate knowledge about the large number of wild plants. This traditional knowledge of tribal communities are now invaluable resources that can be profitably utilized in generating a wide range of IPR covered products and technologies through proper S&T innovation. The ever reaching demand of herbal products such as phytopharmaceuticals, natural colours, flavors and perfumes are the fast growing industrial area in the world over. These people hold a vast area of knowledge on medicinal plants (8000 species), used in treating various ailments. All India Co-ordinated Research Project on Ethnobiology sponsored by Govt. of India has documented over 8,000 species of medicinal plants for treating various diseases. This involve over 1,75,000 formulations for treating various diseases. If India has to enter the fast growing market of plant medicine (phytomedicine) or herbal foods and cosmetics, we will have to enforce stringent quality control measures and introduce transparency. Some of the major impediments in introducing the Indian herbal drugs in the global market are the lack of scientific validation regarding the efficacy and mode of action, standardization, toxicity and shelf-life studies of the drugs. Therefore, India has to develop strategies and techniques with a view to provide a sound scientific validation and standardization. We have to develop appropriate analytical methods (Chromatographic, spectroscopic) and pharmacological evaluation methods.

Katiyar (2012) reported that plants are composed of hundreds of chemical compounds, therefore, drug development efforts on herbs should be in multiple of development of New Chemical Entities (NCEs) as drugs. The emergences of multifactorial diseases like metabolic syndrome have also brought with them the need of multicomponent drugs hitting multiple targets simultaneously. This need can be filled up through herbal drugs, which naturally contain the compounds having synergetic actions. This need gap mentioned above very clearly brings to fore the synergetic involvement of multiple scientific disciplines to understand the herbs in terms of their taxonomy, phytochemical compounds, pharmacological actions, **synergies** or antagonisms of the compounds contained in the medicinal plant's the therapeutic targets hit by them, the pharmacokinetic profile of atleast major bioactive compounds and related scientific studies. The mechanism of action of compounds, their permutation combinations, appropriate extraction technique, fractionation of the extracts, difference from whole to fractionations *etc.* are other factors, which ideally need to be studied to put up these herbs on the scientific footing.

Further, we also need to clinically evaluate the drugs to understand their therapeutic efficacy, metabolomes, system biology, pharmacokinetics *etc.*

Conclusion

In the emerging scenario of the 21st century, phytomedicine is gaining wider acceptance and importance, particularly because of the fact that the biomolecules which constitute phytomedicine are synthesised within the living cells unlike the synthetic molecules which are widely used in the allopathic medicine. Phytomedical research is an interdisciplinary activity involving botany, taxonomy, pharmacognosy, natural product chemistry, biochemistry, medicinal chemistry, pharmacology, pharmaceutical sciences, molecular genetics *etc.* In the literature, we find a large number of Journals devoted to the above mentioned branches of science, but only few of them publish articles from multidisciplinary areas. It is gratifying to see that “Annals of Phytomedicine” is catering to the needs of scientists from different closely related disciplines. A Journal’s standard is gauged by the quality of the papers published in it. It is

therefore, important to accept articles only after strict peer-review, but that should not discourage those who are novice in the art of manuscript preparation. The journal shall encourage innovative contributions from young scientists. I am sanguine that researchers in phytomedicine would find “Annals of Phytomedicine”: An International Journal as the right forum for publication of their work.

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Biography

Padma Shri Professor Palpu Pushpangadan is presently the Director General of Amity Institute for Herbal and Biotech Products Development (AIHBPD), and Senior Vice President of the Ritnand Balved Education Foundation, at Thiruvananthapuram. Prior to the present assignment, Professor Pushpangadan served as Director, National Botanical Research Institute (NBRI), Lucknow from February 1999 to February 2006; Director, Tropical Botanic Garden and Research Institute (TBGRI), Thiruvananthapuram from November 1990 to February 1999 and held additional charges of Director of Rajiv Gandhi Centre for Biotechnology (RGCB) and Central Institute for Medicinal and Aromatic Plants (CIMAP), Lucknow. Dr. Pushpangadan is a multidisciplinary scientist, having over 43 years experience. He has carried out original research in Cytogenetics and Plant Breeding, Biotechnology, Molecular Taxonomy, Biosynthesis of secondary metabolites, Ethnobiology, Ethnopharmacology, Bioprospecting and Natural Product Development *etc.* He has published over 515 original research papers (220 in peer-reviewed journals, 79 chapters in books and 216 in proceedings of scientific seminars/symposia) in national and international journals and proceedings, authored and edited 26 Books and 36 Reports, respectively.

He has about 232 patents (of 95 patents- 61 US patents and 65 European, French, German, Canadian and Japan patents awarded and rest in India) granted and 14 patents filed in India. Twenty of his patented products are now commercially produced and globally marketed. Professor Pushpangadan brought a unique distinction to India as the first in developing a benefit-sharing model that implemented Article 8(j) of the Convention on Biological Diversity (CBD).

Professor Pushpangadan served/is serving as consultant to WHO, DANIDA, UNESCO, UNDP, UNEP and NAM S&T Centre for developing countries UN-CBD, Proctor and Gamble, Godfrey Phillip, Kottakkal Arya Vaidya Sala *etc.* South African Government appointed him (with the permission from Govt. of India) in 2004 to Chair the International Committee to review the five years work of the laboratories of CSIR- South Africa. 48 students received Ph.D/MD under his guidance and 5 are currently registered for Ph.D./M.D. programme in different universities in India and abroad.

Professor Pushpangadan has received many national and international medals/awards including the prestigious **UNEP Borlaug Award** in 1998, the **UN-Equator Initiative Award-2002** at World Summit at Johannesburg, South Africa in September 2002, Ayurved Gaurav Award 2009 and **Padma Shri Award** in 2010. He is a fellow of the Royal Society of Chemistry (FRSC), National Academy of Sciences (FNASc), Fellow of the National Academy of Agricultural Sciences (FNAASc) and also Fellow of five other Scientific Bodies in India. He is the President of National Society of Ethnopharmacology, International Society of Natural Product. He also served as the President of the International Society of Ethnopharmacology (1998-2001), International Society of Environmental Botanist (April 1999 to January 2006). He also served as Vice-President/Chairman/Vice Chairman/Member of many National and International scientific bodies/committees. He has visited over 78 countries in various capacities as Chairman/Leader of Scientific delegation/scientific expert or to participate in International seminars/symposia or to chair the International Expert Panel to review research programmes.

