

Invited commentary

Forests, biodiversity and bioactives security in the era of uncertainty

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Received November 2, 2014; Revised November 30, 2014; Accepted December 5, 2014; Published online December 30, 2014

Habitat to innumerable numbers of living and inanimate entities, forest is an important ecosystem to human survival and wellbeing. Forest ecosystem services include regulation of climate, purification of fresh water supplies, storage and recycling nutrients and formation of soil to name but few. Source to a plethora of useful substances for modern medicine, agriculture, and industry, at least 40% of the world's economy and 80% of the economy of less-industrialized nations, is based on biological resources, directly or indirectly link to the forest (Reed, 2012).

Ever since time immemorial, the forests have been laboratories where Man experiments with mother nature to discern beneficial bioentities; not only to quench his hunger and clothe himself but also to cure his ailment. Examples abound, illustrating the immense value of these indigenous knowledge to modern medicine. For a three decade span, 70% of the modern therapeutic compounds have been traditionally used in its original form, *i.e.*, plants (Newman and Cragg, 2012). Among the 120 bioactive compounds isolated from the higher plants and widely used in today's modern medicine, 80% show a positive correlation between their modern therapeutic use and their traditional use (Fabrican and Farnsworth, 2001).

There is simply so much that one needs to learn from indigenous knowledge, from the healing power of herbs, plants and flowers to the whole ethos of living harmoniously with nature. Man may be highly successful in the former, but is paying a very high price for his failure to learn the latter. Serious environmental crime such as deforestation, depletion of biodiversity, pollution and uncontrolled carbon emission to name but few were legalized in the cause of 'development' and modernization. Man's imprudence has resulted in the climate change phenomenon as manifested by global warming and extreme weather conditions; both with serious implications to the forests which constitute 27% of total land mass world-wide. Housing at least half of all the species known to the world, these changes will have enormous impact on global biodiversity (Phillips and Lewis, 2014).

Plants being the major source of useful compounds, are extremely sensitive to climate changes and fairly slow to adapt. A scholarly review by Ramakrishna and Ravishankar (2011) on abiotic stress influence on secondary metabolites production in a range of plant

species is worth reading. Such body of knowledge on tropical plant species, however, are lacking. Hence, leaving a big question mark on the sustainability of tropical plants derived bioactives.

More than two thirds or at least 35,000 of the world population of medicinal plant species originates from the developing countries (Si-Yuan *et al.*, 2013). What then will happen to these bioactive producers? Will these plants survive climatic change? Will they continue producing the precious bioactive compounds should they survive? Is there any other plant species capable of producing similar bioactives? Can current technology/(ies) synthesize these bioactives or is there any other known means to economically produce the bioactives? The large uncertainties about the magnitude and the unknown effect of numerous adaptations by every biota sharing the big blue planet manifest themselves in the endless questions to match!

Multi drug resistant organisms, emergence of life-threatening pathogens and the tremendous increase in the incidence of non-communicable diseases in the world's population are amongst major challenge for our healthcare providers worldwide. Focusing on the target pathogens or parasites, will they response to the existing mode of intervention in a similar fashion or will the adaptation enable them to resist whatever is left in our health armamentarium? The need for new antibiotics, chemotherapeutic agents and agrochemicals that are highly effective, non-toxic and environmentally friendly to provide assistance and relief in all aspects of man's life is ever growing.

As one of the twelve mega biodiversity nation, Malaysia has to her advantage the mega diverse bioresources and pot-pouri of indigenous knowledge originated from her multiracial communities. A multibillion dollar worth industry worldwide, natural products potential to a nation like Malaysia is simply enormous. Malaysian government, through her Economic Transformation Programme (ETP) acknowledged the need to incorporate these 'green commodity' as an important element to support her emerging bio-economic sector.

In cognizance to modernization threat to both the indigenous knowledge and bioresources, the initiative to document indigenous knowledge from 16 native and Malay communities for further scientific verification has been intensively conducted since 2007. As signatory to Nagoya protocol, Malaysia has also drafted the 'Access Benefit Sharing Law', a mechanism gearing towards smart partnership amongst the stakeholders namely; the indigenous people, researchers, government and other related entities in compliance to one of the core objectives under Convention on Biological Diversity (CBD) 1993.

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Scientists quest for useful entities, or bioprospecting to develop the biospecimens into useful products, using various platform of cutting-edge technologies. Often facilitated by indigenous knowledge, it serves as a methodical search on biological resource for potentially useful design, genes and natural compounds that may be useful for mankind. Bioprospecting for bioactives in this era of uncertainty, become even more crucial should existing therapeutic agents becomes less in number or power. Biodiversity in this regard, governs the success rate of bioprospecting initiative for the much needed bioactives. Maintaining biodiversity then, provides greater bioactives security, opportunities for economic development as well as a foundation for new pharmaceuticals and other medical advances.

Beside various platforms of bioprospecting, development and establishment of the marker technologies (bio-, chemo-, protein and toxico-) for authentication, safety and efficacy evaluation on selected species of interest are of equal importance. As part of quality assurance under Good Agricultural Practice (GAP) scheme, marker technologies has been applied in the development of pre and post harvesting regime of selected species such as *Orthosiphon aristatus* (Blume) Miq. Enabler technologies to ensure sustainability supply of high quality material are also in demand. The non-destructive tissue culture and bioreactor technology to enhance and expedite the useful secondary metabolite production from *Eurycoma longifolia* Jack. help mitigate depletion of wild *E. longifolia* from the forest. At molecular level, *in silico* approach applied in the early development of selected lead bioactives provide valuable data on the compatibility of the bioactive and its' target site. Structural modifications to either enhance the efficaciousness and or reduce the toxicity of the bioactives would entail the Quantitative-Structure Activity-Relationship (QSAR) analysis.

Adoption of holistic and multidisciplinary approach will significantly increase the success rate to enhance the quality of life *via* reducing pain and suffering as well as provision of relief. Former paragraphs have clearly illustrates the importance of solid scientific backup throughout the whole chain of development (from the upstream to downstream processes) to realize the high value premium natural products (standardize extracts, active pharmaceutical ingredient and or phyto-drugs), meeting the global standard of quality, safety and efficacy.

Albeit less popular than food security, bioactives security issue is of equal importance in this era of uncertainty. Given the ramification of climate change to healthcare armamentarium, initiative to share body of related knowledge to face the challenge is most welcome. Encompassing a wide spectrum of shared knowledge on discovery and development of the much needed therapeutics, **Annals of Phytomedicine** in this regard has been promoting a more holistic view on the subject matter. The unique totality approach to complement many other highly specialized journals is highly relevant and much appreciated.

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Biography

Dato' Dr Abd. Latif Mohmod has begun his career at Forest Research Institute Malaysia (FRIM) as a Research Officer on 28 March 1985 upon graduating from the National University of Malaysia (UKM) in 1984. He obtained his Master of Science (M.Sc.) in Forestry (1992) and completed his part-time PhD study in five semesters, specializing in Non-Wood Forest Products from the Agriculture University of Malaysia (UPM) in 1996.

Dr Abd. Latif pioneered and managed Research and Development activities on properties and utilisation of non-timber forest products such as rattan, bamboo and palm. To date, he has published nearly 300 papers in various local and international journals and proceedings, and invented 50 machines (12 registered) for processing of rattan, bamboo, Pandanus and other palms.

He held FRIM's Deputy Director-General of Operations post from 2005 to 2008. The period saw him led the establishment of Conservation Management Plan for FRIM Campus and Land. Due to such an impressive plan, on 2 August 2007, FRIM had successfully secured its Land Title with a total area of 544.3 hectares and FRIM's campus was gazetted as A Natural Heritage Site in 2009. In May 2012, FRIM was gazette as National Heritage by the Ministry of Information, Culture and Heritage, Malaysia. Upon taking up the helm as FRIM's Director- General in May 2008, he led FRIM to emerge as one of the world's recognized referral centre for tropical forestry research, development and innovation. FRIM has since chalked up an array of prestigious awards notably 'Mahathir Science Award 2009'; 'Nikkei Asia Prize Award 2009'; 'APEC Excellent Child Contributor Award 2010', 'National Book Award 2010, 2012 and 2013'; and 'National Innovation Award, 2013'.

Dr Abd. Latif is the Vice Chairman of the Plant Resources of South East Asia (PROSEA) and Chairman of the Asia Pacific Association of Forestry Research Institutions (APAFRI) since 2009. He is, on record, the first and only forestry scientist ever honoured with the Malaysian National Young Scientist Award (1993), National Inventor Award 1997, Eisenhower Fellow of USA (1999), Outstanding Young Malaysian (1999); the youngest recipient of International Union of Forest Research Organization (IUFRO)s' Scientific Achievement Award (1995) in the history of global forestry practice and the Rotary

Research Gold Medal Award (2012) for his research contribution in the field of 'Science-Green Products'. He was selected as FRIM's Most Prolific Author of High Impact Factor Journal in 2010. Dr Abd. Latif was also conferred with the Science and Technology (S&T) Achievement Award in November 2012 by the Malaysian Scientific Association (MSA) to award his outstanding contribution to the S&T development in Malaysia; and recognized as the Top Research Scientist Malaysia (TRSM) in 2013 by the Academy of Sciences Malaysia (ASM). He was recently elected as Fellow of ASM (2014). Dr Abd. Latif is currently the Director-General of FRIM since May 2008 after serving as the Deputy Director-General (Operations) from 2005 until April 2008.