Indian Journal of Biotechnology and Pharmaceutical Research
Journal homepage : www.ijbpr.in
ISSN: 2347-3266
2018, 6(4): 22-24

Short Communication

Bioprospection for Bioactive Molecules of Pharmaceuticals Importance

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Exploring and probing biodiversity for bioactive molecules proteins and enzymes of socioeconomic significance is termed as bioprospecting. Biodiversity encompass all organisms and species, their genetic distinction as well as their complex assemblages of communities and ecosystem diversity present on the earth. The concept, knowledge and mass awareness about the biological diversity is one of the most talked subjects of 21st century. Obviously, human survival is directly linked to its ambient diversity of nature. In contradiction to the fact that the biological resources of the world have been in use to the humanity since ages and thoroughly explored by ancient society, our knowledge of biodiversity is still very limited. Plant diversity as a global resource also remained poorly understood, inadequately documented and often wasted, but still possesses immense potential for further development of useful natural products.

Flowering plants provide a wide variety of foods, drugs, cosmetics, fibers and building materials. However, these constitute only a minor part of the total number of species on the earth and vast resources remain are yet unexplored. The importance of biodiversity exploration for new products was acknowledged during the meeting of International Society of Chemical Ecology in Goteborg, Sweden, in the Goteborg Resolution 1990. In fact plants and plant products are attributed to array of pharmacological efficacies in other to other biological activities. Now-a-days, in contrast to the synthetics which are considered as hazardous and unsafe to environment and human health, plant derived products represent safety and environmental ability. This has necessitated prospecting of botanical resources for exploring safe and effective remedies for human ailments.

Received: 12.10.2018, Revised: 12.12.2018,
Accepted: 20.12.2018

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Bioprospecting of plants for therapeutic molecules

The resource values of a plant species are measured either in term of the plant itself that provides the product or the derived products that serves as a model for a modification. Discovery is often achieved by considering where the desired product might have evolved naturally. Habitats or a group of species are then identified and explored. Further, combinatorial chemistry and rational drug design are modern approaches for drug discovery. While these have been developed independently of natural products, current thought is that natural products are likely to provide the best lead-molecules in the future.

Prospecting phytodiversity

In recent years, the increasing demand for herbal medicines is being fueled by a growing consumer interest in natural products. Based on the knowledge that many important drugs, such as aspirin were derived from natural products, the industries have at various times invested heavily in the exploration of wild plants in search of commercially profitable bioactive molecules. Some common examples include the discovery of anti-malarial drug quinine from *Cinchona sp.*, alkaloid Diosgenin from *Dioscorea deltoidea* used as source for the partial synthesis of cortisone and steroid hormones, hypertensive alkaloid Reserpine from *Rauvolfia serpentina* and the analgesic alkaloid aspirin from *Filipendula ulmaria*, anti-asthmatic alkaloid ephedrine from *Ephedra sinica* and anti-cancer alkaloid Podophyllotoxin from *Podophyllum hexandrum* to mention a few. In addition, a number of new, small molecules, no synthetic chemical entities developed for cancer research are derived from natural products.

In hypersensitive drug research, 65% of drugs currently synthesized can be traced to natural structures. This emphasizes the important role of many natural products as blueprints rather than the actual end points. Today, number of plant derived pure molecules are used as drugs.

Role of traditional knowledge about plants have been the only source of medicine to the indigenous people across the world's civilizations, who possess very rich repository of traditional/folk knowledge about the therapeutic uses of medicinal plants available in their vicinity. The ethno botanical approach to drug discovery is more likely to succeed where people have lived in the same area over many generations and so have had more time to discover suitable medicines. A number of plant-derived medicines used in the western world were originally discovered by studying indigenous medicine. For example, the analgesic and antipyretic drug Aspirin was first isolated from *Filipendula ulmaria* because it had long been used in European folk medicine to treat pain and fevers. Drugs for heart ailments named Digitoxin and dioxin were derived from *Digitalis purpurea*, leaves of which were first used in European folk cure to treat congestive heart failure. Quinine obtained from the bark of *Cinchona* tree has been the single most effective cure for malaria. More recently, the drugs Vincristine and Vinblastine were discovered in the rosy periwinkle (*Catharanthus roseus*) from Madagascar. Vincristine is given to children with leukemia and Vinblastine has cured many people with Hodgkin's disease. Two important drugs have been derived from Mayapple (*Podophyllum peltatum*) used by Native Americans to treat warts; Teniposide to treat bladder cancer and Podophyllotoxin from which a powerful anti-tumor agent has been synthesized. Over 50% of modern prescription medicines were originally discovered in plants and plants continue to be the source of significant therapeutic compounds. Alarming levels of antibiotic resistance in many human pathogens has led to increased herbal bioprospecting, a vital source of lead drug discovery. Personal care and cosmetics industries use wild harvested or cultivated products in a wide variety of products, including cosmetics, hygiene, hair care, baby care, nail care, oral hygiene, deodorants, skin care and fragrance products. The World Health Organization estimates that some 3.5 billion people in the developing world depend mainly on plants for their primary health care. The development of botanical medicines for local peoples is therefore an important contemporary area of research. Many countries, such as Thailand, India, Sri Lanka, Mexico and China, have integrated traditional medicine into their national health care systems. Ethno botanical bioprospecting has therefore contributed both to the enhancement of local medicine and to the search for modern drugs.

Floral diversity is a vast source of future economic development. Recent Industrial Trends empathized that the most novel products are researched, developed and produced in industrial countries and there is a geographical mismatch between centers of biodiversity, which tend to be in the tropics and centers of research and development, which are largely concentrated in the temperate zones. In recent years, several laboratories and some small companies, located in different parts of the world, have applied natural history knowledge and ecological and evolutionary criteria and theory to increase lead discovery. While much pharmaceutical bioprospecting is still controlled by companies in industrial countries, there is a significant pharmaceutical industrial base emerging in developing ones as well. The pace of discovery of pharmacologically useful constituents has been shown to be higher today from marine and microbial sources than from the historically important plant kingdom, including tropical forests.

Benefit Sharing

The issues including development of the drug, the fate of the indigenous intellectual property, benefit sharing and the creation of partnerships within diverse bioprospecting industries has been complex. The Convention on Biological Diversity (CBD) calls for fair and equitable sharing of benefits arising out of the utilization of genetic resources, including appropriate access to genetic resources. The application of the CBD has supported the intellectual rights of indigenous peoples. Since many legal issues were largely clarified in the CBD, the protection of the rights of indigenous communities and source countries has often created tensions, with the investment sector concerned with altered levels of returns and profitability.

The chain of events leading to sales frequently involves multiple stages that include generating the appropriate knowledge, harvesting, processing, manufacturing and distribution. Accordingly, the economics of each stage vary greatly, and assigning and protecting intellectual property is often an underlying

factor. The types of benefits are varied that may include benefits to society such as increased production, better health and cleaner environments; benefits to the local suppliers such as employment, training and capacity-building and benefits to local, regional, national or international corporations in the form of profits.

Most current partnerships also emphasize the benefits of biodiversity conservation. Although bioprospecting research and development tends are concentrated in industrial countries, the benefits to human well-being are often global (Tripathi and Pandey, 2017). The principles for the treatment of intellectual property are well established and include protection of inventions using patents or other legal mechanisms; clear designation of the rights and responsibilities of all partners; sharing of benefits with the appropriate source country parties; disclosure and consent of indigenous or other local stewards; information flow that balances proprietary, collaborative and public needs; and respect for and compliance with relevant national and international laws, conventions and other standards. There is potential conflict between the routine scientific documentation of traditional medicines and the protection of indigenous intellectual property. However, some organizations are considering whether indigenous knowledge in the public domain might be protected in some way. The CBD provides guidance on these issues and calls for a fair and equitable sharing of benefits with indigenous peoples when their ethno botanical knowledge is used in drug research and development. At the global scale, the CBD provides guidelines with respect to terms for prior informed consent and mutually agreed terms; the roles, responsibilities and participation of stakeholders; aspects relating to *in situ* and *ex situ* conservation and sustainable use; mechanisms for benefit-sharing, such as through technology transfer and joint research and development; and the means to ensure the respect, preservation, and maintenance of knowledge, innovations and practices of indigenous and local communities embodying traditional life styles relevant to the conservation and sustainable use of biological diversity, taking into account the work by the World Intellectual Property Organization.

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How to Cite This Article:

Tripathi, M.K., Tiwari, S., Mishra, N., Sharma, A., Ahuja, A. (2018). Bioprospection for Bioactive Molecules of Pharmaceuticals Importance. Indian J. Biotech. Pharm. Res. 6(4):22 – 24.