

EDITORIAL

COLOMBIAN BIODIVERSITY, AN OPPORTUNITY FOR THE STRENGTHENING OF THE PHARMACEUTICAL AND COSMETIC INDUSTRIES

LA BIODIVERSIDAD COLOMBIANA, UNA OPORTUNIDAD PARA EL FORTALECIMIENTO DE LAS INDUSTRIAS FARMACÉUTICA Y COSMÉTICA

Colombia, a country privileged by nature, where diversity of climates are created by large altitude gradients which generate a variety of ecosystems and beautiful badlands, punas, mountain forests, dry valleys, high deserts and salt flats; landscapes that have diversity of plants and animals and we are cataloged as one of the countries as the greatest diversity in the world, preceded by Brazil and followed by Indonesia, China and Mexico [1]. We have 28.000 plants and lichens; it is an invaluable heritage that can give to our country competitive advantages in the discovery and development of active ingredients for the pharmaceutical and cosmetic industry by sustainable use of our biodiversity. However, despite our incalculable richness, we are still subjected to the importation of natural ingredients to develop of cosmetic and phytotherapeutic products and drugs. Why is this happening?

Respect to pharmaceutical industry, animals, plants, and microorganisms are a major source of medicines to treat disease. They have already provided us with treatments for such major diseases as cancer, heart disease, hypertension, inflammatory disorders, and a range of bacterial, fungal, and viral infections. Yet only a tiny fraction of biological species has been studied for potential therapeutic effect. Only 2-5 percent of the estimated 250,000 species of higher plants have been studied. In addition, of the 150 most commonly prescribed drugs in the world, about 50 percent contain at least one major active compound derived from, or patterned after compounds from nature.

The use of plants, extracts or active molecules obtained from natural sources for the treatment of cutaneous affections and to maintain healthy skin of healthy skin it dates back to ancient times to today. Egyptians were the first civilization that used natural products to treatment skin problems or to keep their beauty. They used ostrich eggs, olive oil and resins mixed with milk for this purpose. Currently, vegetable oils, fats and butters are use as emollients; gums, waxes and resins are use as thickeners; honey is a moisturizer; peel and seed powders are exfoliants and essential oils are fragrances. The list of vegetable dyes has been increasing as well as the active ingredients for treatment skin problems and their attachments. New, sure and effective anti-inflammatory, antimicrobial, antioxidant, anti-aging, anti-dandruff and bleaching ingredients from plants are discovery every day. In 2014, the global market for cosmetic products of natural and organic origin was around \$ 33 billion, where Brazil and Pacific Asia were the fastest growing regions and skin care products were the most in demand [2]. In Latin America, Colombia is well positioned in production and exportation of makeup, hair and cleaning products. However, these products have limited presence in attractive markets as Europe, North America, East Asia and South Asia. Similarly, the production and export performance of Colombia in natural ingredients for cosmetic use are reduced too. In Latin America, this market has been led by Brazil and Mexico, followed by Chile and Peru. The Colombia participation in natural ingredients market in the region does not exceed 3% [3]. Then, if we have more biodiversity than our neighboring countries and we have more suitable environment conditions for agriculture of plants with potential cosmetic use, why are we still lagging

behind? Maybe, we could think that our low capacity to use suitably our biodiversity is responsibility to National Government and its lack of appropriate policies for the sustainable exploitation of biological resources. However, in recent years, the Colombian cosmetic sector is being widely supported by the government, which has generated government policies in order to promote the development of cosmetic ingredients and cosmetic products based in or biodiversity. For example, the Policy for the Commercial Development from the Sustainable Use of Biodiversity, Conpes Document 3697 of June 2011; The Productive Transformation Program (PTP) and its Quality Program for the Cosmetic Sector (SAFE +); The Program Agreement Competitiveness; The Program Colombia, Natural Advantage in Cosmetics and Toilet Products, where all their projections are based on the most important competitive advantage of our country: its biodiversity [4]. Also, recently the Department of Environment and Sustainable Development has issued the Resolution 1348 of 2014, in which is described a clarification to Andean Decision 391 of 1996 regarding access to genetic resources and their derivative products, giving a clear, concrete and accessible way to the commercial and sustainable use of our biodiversity. Then, what has happened with development of ingredients and natural cosmetics in Colombia? Why do most national cosmetic companies still import natural ingredients and raw material to their products? What has been the investigation field of pharmacy and natural science faculties in our country? Many answers can originate to these questions. We think that we have focused our technical capabilities and resources on basic research in traditional fields such as energy, health, agriculture, among others. The few researchers on biodiversity have focused on bioprospective studies and chemical characterization, which finish in recognized or non-recognized scientific publications. The researchers have been focused in global scientific problems forgetting our own needs, strengths and weaknesses. Thus, researchers in pharmacy and natural sciences faculties know few about needs and problems of small and large national cosmetic and pharmaceutical companies and these companies completely ignorant of the scientific and technological capacities of groups and research centers.

Products derived from biodiversity have served as the source and motivation for a large amount of the current marketed drugs. Although estimates vary, it is considered that between 25 and 50% of currently pharmacopoeia had their origins from natural products. Microbes, plants and animals have been the source of new drugs. For example, from the discovery of Penicillin by Alexander Fleming [5] up to discovery of antitumor agents, daunomycin-related agents, microorganism have been a great start point to screening for new drugs [6]. In the same way, several drugs had their origin in marine organisms, such as microbes, microalgae and animals. One of the most representative examples is Ziconotide, which is a 25-amino acid peptide, isolated from a marine snail *Conus magus* [7] and approved by FDA in 2004 as analgesic in chronic pain under the name of Prialt[®]. On the other hand, many of the clinically used drugs derived from natural products originated from plants, and it is certain that the present of mankind would be different without such natural plant-derived drugs as morphine, vinblastine, vincristine, quinine, artemisinin, etoposide, teniposide, paclitaxel, and the camptothecin derivatives topotecan and irinotecan, only by mentioning some examples [8].

In 1967, Sergio Ferreira discovered an antihypertensive molecule in the venom of the Brazilian snake *Bothrops jararaca*. Subsequently, he traveled to Europe, and worked with several researchers, finding the mode of action, which was to block the angiotensin converting enzyme (ACE) and the peptidic nature of the molecule. The compound was named Trepotide. Several chemical modifications were made and passed through a peptide analog, and then, they obtained the molecule that is known now as Captopril, an inhibitor of the ACE [9], nowadays, it is used for the treatment of hypertension. In addition, this molecule has been used for the development of new ACEi, with better activity and lower incidence of adverse reactions. From the discovery of Captopril, animal poisons were considered as sources rich in bioactive compounds, with potential uses as drugs. That is how, researchers taken into account the biological effects of two toxins, barbourin and echistatin from *Sistrurus barbouri* and *Echis carinatus*, gave origin to Eptifibatide (Integrilin[®]) and Tirofiban (Agrastat[®]), which are used in acute myocardial infarction [10]. Similarly, a peptide derived from Gila monsters (*Heloderma suspectum*) saliva named Exenatide, have been approved by FDA as a drug for the treatment of Diabetes mellitus under the name of Byetta[®] [11]. These examples tell us about the versatility of the venoms as a drug source.

It is important to mention that biodiversity have also contribute to the development of pharmaceutical excipients, for example the most common are derived from cell wall plants (cellulose, hemicellulose and pectin) which are used as diluents or filler/binder in tablets for both granulation and direct compression processes. However, there are also a seaweed polysaccharides, such as Alginate isolated from Phaeophyceae family, carageenans purified from Rhodophyceae family, represented by *Chondruscrispus*, *Euchemaspinosum*, *Gigartinaskottsbergi*, *Gigartinastellata*, *Iradaealaminariodes* which are red seaweeds and Gum agar, that is extracted from the red-purple marine algae of the Rhodophyceae class. All of these polysaccharides are widely used in pharmaceutical preparations as bulk material or ingredients in drug delivery systems. These are only some examples that support the importance of biodiversity in the pharmaceutical technology [12].

Therefore, knowing that we have enough biological resources, agroecological conditions suitable for agriculture, sufficient technical and scientific capacities, this is an invitation to industry, academy and government let's do a coherent and planned integration of needs and capacities, with public and private economical resources, to formulate strategies that allows the bio-sustainable use of our biodiversity. For this, is necessary formulate integrated programs and projects to identification and selection of interesting plants, to identification of active ingredients with potential cosmetic and/or pharmaceutical use, the development of domestication programs and management plans, the scaling of processes to obtain active ingredients, the design and formulation of high quality products with natural ingredients and design and implementation of commercial strategies that allow the promotion and positioning of ingredients and cosmetic products from our biodiversity in attractive markets.

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