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International Legal Protection of Genetic Resources Against Biotechnological Piracy

Tounsi Sabrina
Faculty of law, Algiers University1, Algeria
Economic Law Research Laboratory
s.tounsi@univ-alger.dz
https://orcid.org/0009-0005-8481-5139

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Abstract:
The various applications of biotechnology depend on genetic resources, whether they are plants, animals or microorganisms. The close interdependence between biotechnology and genetic resources is clear, as genetic resources are used to improve agricultural varieties and develop biotechnological industry products, such as foodstuffs and pharmaceuticals, while providing biotechnology solutions to agricultural, medical and industrial problems. Genetic resource piracy occurs when a country's vital resources are seized without permission or acknowledgement of ownership, allowing them to be used to establish global economies. To confront biopiracy, we must respect the sovereignty of countries over their wealth and recognise the genetic resources of developing countries.
Keywords: Biohacking; Genetic resources; Piracy; Risks; Legal protection.

1. INTRODUCTION

Knowledge and technical progress are continuous. This century has been called the 'century of scientific revolution', although the world has experienced many revolutions. However, the most dangerous revolution is the current biotechnology revolution, which is used in all fields today. In agriculture, it may lead to solutions for many issues around the world as well as in medicine and industry[1].

Biotechnology involves using genetic resources to develop various applications. It has played a major role in the development of new products that increase human well-being, such as life-saving medicines and ways to improve food security. Consequently, genetic resources have become the focus of industrial innovation by multinational companies and research centres[2].

The latter have demanded intellectual property rights for the vital products they develop. The gap between countries with genetic resources and countries with the financial and technological resources to conduct research was exploited by the emergence of the 'green gold' myth. As genes acquired an economic dimension, the sustainable use of biodiversity became doubly threatened[3].

It is a biological fact that 90% of the world's biological resources are found in developing countries. Many people in these countries have accumulated expert knowledge about using these resources for food and medicine. This knowledge is further enhanced by the original innovations of hard-working farmers in the areas of cultivation, hybridisation and breeding.

This collective knowledge, accumulated over generations, has nourished and healed the world for centuries. In the field of medicine, for example, it is estimated that three-quarters of the plants used to produce active ingredients in prescription drugs came to researchers' attention because of their use in traditional medicine.

The current value of the global market for medicinal plants that have benefited from indigenous knowledge is estimated at US$43 billion, and the value of the international industry for seeds of crop varieties developed and improved by traditional farmers is estimated at US$15 billion[4].

Genetic resources, such as plants, animals and microorganisms, are a source of food, clothing and medicine. They have high economic value and form part of the cultural heritage of traditional communities and indigenous peoples. This means they are linked to ecological, social and cultural values, collectively known as traditional knowledge related to genetic resources[5].

The advent of biotechnology has led to a convergence in the protection of industrial and biological innovations. The first patent application for a genetically modified plant was filed in 1983, and the first patent for a plant species was granted in the United States of America in 1985. However, agricultural and pharmaceutical biotechnology companies and institutes have also been granted patents on plant resources or products derived from them, even though these resources are often low-cost or based on indigenous knowledge. This is known as biopiracy.

Algeria is a developing country with a huge genetic wealth, and its biodiversity is an important resource that benefits several economic sectors such as agriculture, industry and tourism. This diversity has made Algeria the target of many researchers and multinational companies.

This topic is one of the most important issues of our time, given the significance of genetic resources as an environmental and economic pillar for countries. These resources are the subject of conflict and covetousness between countries that are rich in them and developed countries that possess the technology to exploit them.

This study aims to shed light on the concepts of biotechnology and genetic resources, as well as biopiracy, highlighting the dangers and implications of the latter on genetic resources and ways to combat it.

In our study of this topic, we adopted a descriptive and analytical approach, defining the terms 'biotechnology', 'genetic resources' and 'biopiracy', as well as exploring the implications of the latter for genetic resources.

This leads us to ask the following question: What will the future hold for genetic resources in the shadow of biotechnology?

In order to answer the above question, we divided our study into two axes, the first axis included the idea of the relationship between genetic

resources and biotechnology, while the second axis included the risks that biotechnology poses to genetic resources and ways to address them.

2. International Legal Protection of Genetic Resources Against Biotechnological Piracy

Genetic resources, including plants, animals and microorganisms, are important for many developing countries. These resources have been used for nutrition, medicine and trade, and are essential to human development. This has led to their diversification; Similar to many other terms, the term 'genetic resources' necessitates a search for its meaning[6]. The study also requires a definition of biotechnology, since this is the field in which genetic resources are developed.

2.1 Definition of genetic resources

Genetic resources are the raw materials on which the world relies to increase the productivity of plants and animals, as well as the quality of their products.

The 1992 Convention on Biological Diversity defines genetic resources as any material of plant, animal, microbial or other origin that contains functional units of inheritance and has actual or potential value. Examples include medicinal plants, agricultural crops, and animal breeds. Some genetic resources are linked to traditional knowledge and practices through their use and conservation by indigenous peoples and local communities over successive generations[7].

Genetic resources themselves, as they occur in nature, are not intellectual property. They are not creations of the human mind and therefore cannot be protected directly as intellectual property[8]. However, inventions based on or created using genetic resources are eligible for protection through the intellectual property system[9].

The term **'germplasm'**, meaning genetic assets, was the first used by the Anglo-Saxons to express genetic resources. The English translated this as '**germoplasme**', corresponding to the concept of germline and somatic cells that appeared at the dawn of Mendelian genetics. The Australian scientist Otto Frankl is considered the first to use the term **'genetic resources'**. Frankl

was also the first to use the term **'genetic resources'**.

The Convention on Biological Diversity (CBD) defines genetic resources as follows: 'genetic material of actual or potential value'. It also defines genetic material as 'material of plant, animal, microbial or other origin that contains functional units of inheritance'[10]

Although the Convention on Biological Diversity defines genetic resources[11], much legislation does not distinguish between these and other biological resources. With reference to Algerian legislation, Article 2 of Law No. 14-07 considers genetic resources to be part of biological resources[12].

2.2 Definition of Biotechnology

The study of the applications of biology, biochemistry, chemical engineering and bioengineering is known as biotechnology[13]:

Biotechnology is any technology based on biology. In other words, biotechnology harnesses cellular and biomolecular processes to develop technologies and products that improve our lives. The term 'biotechnology' is derived from the Greek words 'bios' (meaning life), 'technos' (meaning technology), and 'logos' (meaning language and mind). This indicates that biotechnology involves the technical use of living organisms for various purposes, such as food production, medicine, pharmaceuticals, and recycling. There are several definitions of the term 'biotechnology', including biotechnology, biotechnology [14], biotechnology, and biotechnology, It is also a technology that utilises biological phenomena to copy and produce useful bioproducts[15].

Biotechnology is the ability to apply knowledge related to living organisms and utilise skills and innovations in various fields on a scientific basis, with the aim of applying them to living organisms. In other words, it is a technology based on controlling and manipulating biological genes within living organisms[16].

Some define it as the use of animals. Others define it as the use of plants. Some define it as the use of fungi. Others define it as the use of bacteria. And some define it as the use of viruses. All of these are used to produce useful substances. These substances are things that humans need. Examples of these things include food and medicine. It also involves manipulating living

organisms at the cellular and subcellular levels to maximise their industrial and agricultural — and therefore economic — benefits by optimising their properties and genetic traits[17].

Green biotechnology is related to agricultural crops, including genetically modified crops, yellow biotechnology is related to the utilisation of insects at all levels and in all fields, whether agricultural, health or food[18], and red biotechnology is related to bioproducts responsible for treatment and diagnosis in healthcare, including gene therapy, and red biotechnology is related to bioproducts responsible for treatment and diagnostics in the field of healthcare, including gene therapy, Structural biotechnology focuses on organisms that inhabit deserts, arid regions and wastelands. It uses these organisms to reclaim land and develop new ways of managing limited resources, Black biotechnology refers to the use of biotechnology in the production of biological weapons for warfare. Purple biotechnology, on the other hand, focuses on the philosophical, ethical, intellectual property and international law issues associated with biotechnology applications that are safe and beneficial to humans[19].

2.3 Genetic Resources as a Source of Biotechnology

Biotechnology relies on genetic resources, which encompass the genetic assets of plants, animals and microorganisms, as well as the traditional knowledge and local practices surrounding them that have been accumulated over the years[20]. These genetic resources are fundamental to the various applications of biotechnology[21], These resources, whether they are plants, animals or microorganisms, represent the backbone of biotechnological development. Biotechnology aims to improve these organisms through advanced techniques that benefit all of humanity. Additionally, it seeks to protect the environment by shielding plants from diseases and minimising their reliance on chemical fertilisers.

Genetic resources and biotechnology are closely interlinked. Genetic resources are used to improve agricultural varieties and develop food and pharmaceutical products for the biotechnology industry. Meanwhile, biotechnology provides solutions to agricultural, medical and industrial issues. However, this interrelationship will only be beneficial if genetic

resources are used sustainably, through the conservation of biodiversity and the use of viable genetic resources via biotechnological techniques[22]. The use of biotechnology has opened up many possibilities for improving, identifying and transferring genes for various traits from one organism to another, whether plant or animal, with the aim of developing and enhancing them. For example, crops that are resistant to disease and drought are being cultivated[23]. The FAO has conducted studies on how agricultural biotechnology can benefit small-scale farmers and help the poor. The organisation believes that biotechnology has real potential as a tool to address the challenges posed by Bbn, global population growth. For example, it could be used to make bananas disease-free. Disease outbreaks have affected banana production and cannot be prevented using traditional methods due to the high cost and harmful environmental effects[24].

3. Risks to Genetic Resources from Biotechnology and How to Address Them

Due to the importance of genetic resources as raw materials for biotechnology at an international level, countries have tried to pay attention to them in light of the dangers they face. Perhaps the most significant of these dangers is biopiracy and its detrimental impact on developing countries. This has prompted them to develop strategies to address the issue and safeguard their resources[25].

3.1 Biological Piracy of Genetic Resources

Biotechnology is one of the most important factors that has led to the spread of biopiracy. The technology for collecting and transferring genes from one organism to another was developed in laboratories in industrialised countries, particularly the United States, while the raw materials and genes are found in the genetic resources of countries in the Global South. Rather than taking a fair and just approach and entering into an agreement with the holders of these genetic resources to use them and share the profits resulting from the marketing of products, Western countries resorted to biopiracy as a way to access these raw materials[26].

a- Definition of Biopiracy

Biopiracy is defined as: The appropriation of biological assets and

knowledge from other countries by major countries, and the subsequent exploitation of this knowledge to obtain and register patents without the consent or licence of the right holder.

Biopiracy is also defined as follows: 'the use of intellectual property systems to legitimise the exclusionary ownership and control of biological resources, products and production methods that have been used by non-industrialised cultures for centuries'. It includes granting patents without meeting the necessary legal conditions, since patents are often applied for on genetic resources found in indigenous and local communities, which are derived from their traditional knowledge.

"The term '**biopiracy**' refers to commercial companies owning indigenous peoples' traditional biodiversity-related knowledge. It is a complex phenomenon combining economic and environmental issues relating to the rights of indigenous peoples and international law," said a French anti-biopiracy organisation.

Piracy of genetic resources occurs when a country's biological resources are used without permission or acknowledgement of ownership, and then used to establish global economies. This is particularly relevant in the context of the development of biotechnology, which has impacted all genetic resources — including plants, animals and microorganisms — by altering their biological functions through the addition of genes carrying new desirable traits or the isolation of genes carrying undesirable traits, Illegal access to these resources is considered biopiracy.

b- Practical Cases of Biopiracy

Monsanto, one of the largest multinational companies operating in the field of biotechnology, was the first victim of genetic piracy when it obtained a court judgement requiring a Canadian farmer to pay substantial financial compensation for replanting canola seeds purchased from the company in 1997. The company had stipulated in its contracts for the sale of genetically modified seeds that they should not be replanted. Monsanto owns the intellectual property rights to distinctive, high-yielding, disease-resistant varieties that have been genetically manipulated. The company took legal action against a Canadian farmer after accusing him of using its genetically

modified seeds again, which violates the patent rights granted to Monsanto. The farmer was ordered to pay Monsanto $15,450 in compensation for violating the patent rights[27].

Many biopiracy operations have been and continue to be carried out by multinational companies. Some of these have been discovered, while others remain secret. Among the most important of these are:

Genetically modified cotton has been cultivated in various countries around the world. Monsanto began the first trials in complete secrecy in Burkina Faso in 2001. This is an example of the theft of the country's biological wealth, as well as the use of the region as a testing ground for this type of cultivation[28].

- Turmeric (Curcuma): This plant from the ginger family produces saffron-coloured substances that are used as a spice to flavour Indian food. It also has properties that make it an effective ingredient in medicines, cosmetics, and colouring pigments. It is also traditionally used to heal wounds and skin rashes. In 1995, two Indian citizens in Mississippi were granted patent number 5,041,540 for using turmeric to heal wounds. However, the Indian Council for Scientific Research asked the US Patent and Trademark Office to reconsider the patent.

The Indian Council of Science and Industrial Research argued that turmeric has been used for thousands of years to heal wounds and rashes, and therefore its medicinal use is nothing new. They provided documentary evidence of traditional knowledge, including a text written in the local language and an article published in the 1953 Journal of the Indian Medical Association. Despite objections from the patent holders, the US Patent and Trademark Office upheld the Indian Council of Scientific and Industrial Research's objection and cancelled the patent[29].

- Basmati rice: This type of rice is grown in the Punjab provinces of India and Pakistan. The grains are thin, long and flavourful. Originating from this region, it is a major export crop and a source of livelihood for thousands of farmers in both countries.

The dispute over basmati rice began in 1997 when the US company Rice Tech was granted a patent for a plant and seeds that sought to

monopolise different varieties of rice, including some with characteristics similar to basmati varieties[30]. The company has patented 22 varieties of basmati rice, which were obtained by crossbreeding traditional basmati rice varieties grown in India with semi-dwarf rice varieties grown in Texas. The company markets the new varieties under brands such as Texmati and Casmati. The granting of this patent undermines the role of the Indian farmers who developed these varieties. It eliminates their role and prevents them from cultivating the rice without a licence. Concerned about the potential impact on exports, India requested a review of the patent in 2000. In response, the patent holder withdrew several applications, including those involving Basmati rice.

- Neem: The neem tree is native to the Indian subcontinent. Extracts from the oil-rich seeds of this plant have been used for centuries to make medicines, soaps and toothpaste. Several neem-derived products, including some pesticides, medicines and cosmetics, have been introduced to the Indian market by small and medium-sized Indian laboratories. These laboratories have not attempted to patent the compositions of these products, as prohibited by the Indian Patents Act of 1970.

In the early 1970s, patents were granted for neem extracts in both Europe and the United States. Researchers at the National Institute of Immunology in New Delhi obtained a patent for neem oil extracts, from which products related to abortion and contraception were developed. While there are many patents on neem-based products, the most controversial is that held by the American company W.R. Grace. This is because the company relied on traditional Indian knowledge about the plant without acknowledging its existence, which is considered biopiracy.

All of these forms of biopiracy are carried out by multinational companies, which strive to document them within the intellectual property system. The United States of America, the leading producer of genetically modified materials, has not ratified the Convention on Biological Diversity. Article 15 of this convention provides for the sovereignty of states over their genetic resources, in order to preserve the freedom and profits of biotechnology companies, based on the principle that the end justifies the

means. This is the hidden face of biotechnology and the resulting genetically modified organisms (GMOs)[31].

3.2 The Negative Effects of Biopiracy

In addition to the piracy of genetic resources through biotechnology, which results in the theft of resources from developing countries in favor of developed countries, genetically modified crops have negative effects. In the United States, for example, a genetically modified potato crop designed to resist harmful beetles has been shown to kill beneficial beetles. Similarly, genetically modified corn designed to resist insects has been found to transfer a gene from a type of bacteria to the corn, causing it to produce a toxic compound that kills biting lice. However, the wind can carry this pollen more than 60 meters to the surface of milkweed plants, where monarch butterfly larvae can ingest it and die[32].

Biopiracy negatively impacts the biodiversity of developing countries. When companies produce new plant or animal strains, they monopolize them under intellectual property rights and resell them to developing countries at high prices, even though the latter are the primary contributors of the knowledge or material. These countries cannot produce or import the same crops without the right holder's permission, making them permanently dependent on patent holders. Not to mention, biopiracy threatens the food security and biodiversity of developing countries[33].

3.3 Strategies for Stopping Biological Piracy

To confront biopiracy, we must respect the sovereignty of states over their resources and recognize the traditional knowledge of developing countries. As the most relevant international agreement related to the environment, biodiversity, and traditional knowledge, the Convention on Biological Diversity aims to preserve biodiversity, promote its sustainable use, and ensure the fair and equitable sharing of benefits resulting from the use of genetic resources. Thus, we will address these mechanisms through two points.

a. Respect the principle of state sovereignty over their wealth

Article 3 of the Convention on Biological Diversity states: "In accordance with the Charter of the United Nations and the principles of international law,

states have the sovereign right to exploit their own resources in accordance with their environmental policies. They are also responsible for ensuring that activities carried out within their jurisdiction or under their control do not harm the environment of other states or areas beyond their jurisdiction."

Respecting the sovereignty of states over their wealth requires prior consent from those states to access their genetic resources, as well as adherence to their laws. Respect for state sovereignty also requires the fair and equitable sharing of benefits resulting from the commercial use of these resources. The Convention on Biological Diversity aims to strike a balance between making genetic resources available to all and ensuring that states receive a fair share of the benefits when using these resources and knowledge[34]. However, it did not specify the terms of sharing, leaving this issue to be negotiated between the parties, The Convention also obligates members to protect the rights of nationalities, peoples, and farmers who hold these genetic resources. These rights are established through their utilization[35].

b. Recognizing the Genetic Resources of States

International intellectual property agreements, particularly the TRIPS Agreement, lack rules that protect the rights of genetic resource owners. Therefore, developing countries must legally protect their genetic resources by registering them in databases and making them available to patent offices to prevent patents from being granted on previously known resources.

This is achieved by developing a binding international instrument that recognizes the rights of genetic resource owners as a new area of intellectual property, balancing the desire of developing countries to preserve and benefit from their biological wealth with the interests of developed countries that wish to obtain these resources. This will encourage developing countries to accept the protection of biological wealth through intellectual property rights because they will have a vested interest[36].

Algeria is rich in genetic resources, making it vulnerable to biopiracy. This prompted the adoption of legal texts to address the issue, with the most prominent being the Biological Resources Protection Act 14-07.

4. CONCLUSION

In conclusion, biotechnology aims to improve plants, animals, and organisms through advanced technologies that benefit all of humanity. Additionally, this technology seeks to protect the environment by shielding plants from diseases and minimizing their dependence on chemical fertilizers. Biotechnology and genetic resources are linked because genetic resources are used to improve agricultural varieties and develop biotechnological products, such as food and pharmaceuticals. Biotechnology also provides solutions to agricultural, medical, and industrial issues.

Biotechnology is one of the most important factors that has led to the spread of biopiracy. The technology to collect and transfer genes from one organism to another was developed in industrialized countries' laboratories, while the raw materials and genes are found in the genetic resources of countries in the Global South. Rather than taking a fair and just approach and entering into an agreement with the holders of these genetic resources to use them and share the profits resulting from the marketing of products, Western countries resorted to biopiracy to access these raw materials. They chose to steal these resources under the cover of patents.

Through this process, we arrived at the following recommendations:

- Adopt organic agriculture that preserves ecosystems and relies on agricultural cycles without external inputs, such as synthetic fertilizers, pesticides, and GMOs.
- Countries, including Algeria, must fulfill their obligations after ratifying international conventions by establishing legal systems and administrative apparatuses that align with the conventions' content to protect genetic resources.
- Rationalize and protect genetic resources.
- Strengthen advanced scientific research in agriculture carried out by the public sector and provide adequate funding to prevent piracy.
- Develop legislation that excludes the patenting of biological products and aligns with international conventions, such as the Convention on Biological Diversity (CBD).

- States should establish national registries to inventory genetic resources within their borders.
- They should also work to establish seed banks to preserve genetic assets in the form of samples.
- Urge local peoples to recognize the importance of biotechnology without allowing biotechnological development and technology transfer to be an excuse for developed countries to exploit developing countries.
- Take the issue of biopiracy as a moral obligation for all societies and consider it the current generation's obligation to the next.
- National laws alone are insufficient to combat international piracy; an effective international treaty is necessary.

5. Endnotes

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The term biological resources includes the following categories: Culturable collections of living organisms (microbial, plant, animal and human cells) Reproducible elements of these organisms (tissue fragments, nucleic acids...) Viable, but not reproducible, organisms, cells and tissues Databases containing molecular, physiological and structural information related to these collections Databases containing molecular, physiological and structural information related to these collections.

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[9] Article 2/1 of Law No. 14/7 states: ".... means biological resources: Genetic resources, objects, elements, populations or every biological element of ecosystems of actual or potential value to humankind".

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[11] Traditional knowledge is generally understood as the know-how, skills, innovations, and practices developed by indigenous peoples and local communities. Traditional handicrafts are a form of traditional knowledge. Nutmeg, for example, has been used since ancient times to treat oral diseases in Indian systems of medicine (citing the Practical Guide on Intellectual Property of Indigenous and Local Communities, WIPO, 2018).

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