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**Review Article**

# Regulations regarding biopiracy in the World and in Turkiye

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## ABSTRACT

The term "biopiracy" refers to the unauthorized and uncompensated utilization of genetic resources or traditional knowledge from one country by another country or corporation for commercial purposes. As a nation rich in biodiversity, Turkey faces significant vulnerabilities to biopiracy. This study aims to analyze Turkey's policies on biopiracy while drawing on global examples of effective strategies to combat this issue. The findings reveal that numerous countries actively engage in combating biopiracy. However, Turkey lacks international patent cases or notable initiatives addressing biopiracy. The study concludes that Turkey's current policies and approaches may be inadequate to prevent potential biopiracy incidents or foreign patents on its genetic resources, underscoring the urgent need for a more comprehensive and proactive strategy.

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## INTRODUCTION

Advancements in genetic technologies since the 1990s have generated significant optimism while simultaneously raising concerns about potential environmental challenges. Following the 2000s, these advancements have, on the one hand, emphasized risks associated with various species and, on the other, facilitated the "commodification" of biodiversity. This trend has given rise to new challenges such as "biopiracy." It can be argued that recent economic approaches have accelerated the potential risks posed by biotechnology. Neoliberalism, which has dominated international regulations since the 1980s to promote free trade, has exacerbated biodiversity-related issues. Policies designed to safeguard intellectual property rights and biotechnological inventions have prioritized the interests of developed nations and multinational corporations (MNCs) at the expense of indigenous peoples, who rely on traditional knowledge developed over centuries for their survival.

In the aftermath of recent economic and technological developments, there has been an increasing global interest in biological resources and biodiversity, especially since the 2000s. Notably, over 3.4 million biodiversity-based products were patented between 2002 and 2011 [1]. In response to these developments, the international adoption of a sustainable development approach emerged after the 1990s, accompanied by various agreements on biodiversity protection and usage rights. However, despite these protective international policies and agreements, economies and technologies reliant on biodiversity have become increasingly dominant. Consequently, the unauthorized and uncompensated transformation of genetic resources or traditional knowledge from one country into commercial products by another country or corporation—commonly referred to as "biopiracy"—has intensified.

While the encroachment by MNCs on the sovereignty of nations over their biodiversity presents a significant issue, a more critical concern lies in the dispossession of local populations of their rights to utilize biodiversity and associated traditional knowledge. For example, it is documented that 11,690 instances of traditional knowledge rooted in natural

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resources vital for indigenous communities' survival in Peru have been patented by MNCs. These corporations have systematically acquired patents and intellectual property rights for ancient knowledge regarding seeds and plants, thereby appropriating the cumulative wisdom developed by farmers, forest cultivators, and local communities over millennia. This phenomenon, aptly termed "biopiracy," is often equated with piracy due to its exploitative nature [2].

Presently, more than 7,000 pharmaceutical products are derived from plants. According to the World Health Organization (WHO), approximately 80% of the global population relies on traditional knowledge-based treatments to meet their healthcare needs. In India alone, over 1 million individuals serve as healthcare practitioners relying on traditional knowledge. Similarly, more than 90% of basic food requirements in Sub-Saharan Africa are fulfilled through traditional agricultural practices. Hence, in developing countries, biodiversity and traditional knowledge constitute essential survival pillars [3]. Indigenous peoples often inhabit regions rich in biodiversity, with an estimated 85% of known plant species located within their territories. These communities, concentrated in 12 countries housing approximately 50-80% of global biodiversity [4], face dual pressures: sustaining livelihoods by preserving biodiversity and simultaneously resisting commercial exploitation by MNCs.

Several countries long affected by biopiracy have made notable strides in combating it through international advocacy and domestic policy measures. However, in Turkey, the issue of biopiracy remains relatively underexplored in international law, national politics, public administration, civil society, and public discourse. Despite its growing prominence, Turkey has yet to develop comprehensive tools and policies to address biopiracy effectively. The problem remains inadequately recognized, leading to insufficient combat mechanisms.

This study aims to elucidate the problem of biopiracy by highlighting countries that have achieved significant progress in this area, followed by an examination of Turkey's challenges, approaches, and policies in combating biopiracy. A study by Güler and Mutlu employed document analysis to evaluate policies combating biopiracy through government programs, development plans, strategic plans, and party agendas, with a focus on the period up to 2023 [5]. Soysal examined the legal and intellectual property frameworks within the context of national and international agreements regarding biopiracy [6]. Additionally, Birben and Gençay explored the political, institutional, and legal regulations addressing biopiracy in Turkey [7]. These studies analyzed international conventions and policy instruments globally while evaluating Turkey's legal framework. The methodology of this research involves a detailed literature review of primary and secondary sources related to biopiracy. This approach provides a basis for describing, interpreting, and comparing biopiracy incidents globally and within Turkey. Relevant documents, reports, and academic articles were accessed online to identify the similarities and differences between Turkey's strategies and global policy instruments. In doing so, this research aims to provide a comprehensive understanding of the effectiveness of Turkey's combat mechanisms against biopiracy and propose actionable recommendations for improvement.

## BIOPIRACY AND REASONS FOR THE SPREAD OF BIOPIRACY

In the latter half of the 20th century, advancements in science and technology became increasingly significant as inputs for production processes. During this period, the rise of neoliberalism coincided with an increase in technological interventions involving biological resources, which subsequently amplified the importance of genetic resources. In this context, biological resources came to be viewed as novel commodities, enabling multinational corporations (MNCs) to synthesize and introduce new products in the fields of medicine, agriculture, and cosmetics [37]. By applying engineering techniques, MNCs began to derive new products from biodiverse resources, often incorporating additional features to enhance their marketability. Furthermore, these corporations sought to capitalize on the traditional knowledge of local communities to reduce research and development (R&D) costs in the rapidly growing pharmaceutical sector. Institutes for the study of tropical diseases and medicine began to emerge towards the end of the century. The impact of European diseases on native populations was also a major concern for colonial administrations. The documentation of local medical practices, and the use of native plant material, soon became part of the process of fighting disease. The value of new drugs and the internationalization of the chemical and pharmaceutical industries led to a far more systematic exploration of the plants used by native peoples under colonial rule [38]. Once developed, these new products were patented and protected through trademarks and registrations. This process, dominated by global chemical companies, has been referred to as "life sciences." MNCs often justify these practices with claims such as, "Without these patented products, the world would face hunger, and the increasing food and health needs of a growing population would remain unmet." As a result, the global landscape has intensified the demand for biological resources among MNCs for such ventures.

Biopiracy, defined as the unauthorized appropriation of biological resources or traditional knowledge into private property or monopolies through patents, without the consent of indigenous communities, can be understood in three distinct stages: At the first stage, biopiracy actors, typically individuals or organizations, exploit methods and knowledge that indigenous communities have utilized for centuries. These actors do so for the commercial benefit of MNCs in sectors such as pharmaceuticals, cosmetics, agriculture, and food. An example of this is Eli Lilly, one of the first pharmaceutical companies accused of biopiracy. The company developed two drugs using the rosy periwinkle, a plant species native to Madagascar. These drugs, used to treat Hodgkin's disease and childhood leukemia, generated $100 million in revenue for the company. However, neither Madagascar nor its indig-

enous communities received any royalties. Representatives from such corporations often visit biodiversity-rich regions under the guise of tourism, identify active compounds in natural resources through preliminary research, and return to their home countries with simple samples. In the second stage, the collected samples and field observations are analyzed in laboratory settings to identify valuable components. These companies then claim intellectual property rights, framing these findings as "inventions." Finally, in the third stage, these inventions are marketed and recognized as innovations. With only minor modifications in a laboratory, biological resources based on traditional knowledge used by indigenous communities for centuries are transformed into proprietary assets. Although international regulations outline principles and standards to address biopiracy, challenges persist in achieving effective global cooperation and enforcement. Consequently, biopiracy incidents are likely to increase in the coming years. These legal gaps, combined with the intellectual property regime, may undermine international conventions designed to protect biological diversity. The table below presents the key international regulations addressing biopiracy, highlighting the need for stronger global agreements to combat this growing issue.

The WIPO Treaty on Intellectual Property, Genetic Resources, and Related Traditional Knowledge was adopted at the Diplomatic Conference held at the WIPO headquarters in Geneva between May 13-24, 2024. This agreement represents a significant development in the effort to prevent biopiracy following the adoption of the Nagoya Protocol [10].

While the principles of the UN Convention on Biological Diversity (CBD), one of the most important international agreements for protecting biodiversity, safeguard the rights of indigenous peoples and advocate for the sustainability of genetic and biodiversity resources and their fair and equitable sharing, the Agreement on Trade-Related Intellectual Property Rights (TRIPS) primarily seeks to protect intellectual property or patents. This system gives states the rights to prescribe political regulations for access to genetic resources [37]. Consequently, biodiversity or traditional knowledge, which is often rooted in indigenous communities, becomes susceptible to patenting attempts (biopiracy) by multinational biotechnology, pharmaceutical, or seed companies, which do not necessarily adhere to the principles of benefit-sharing. TRIPS is one of the most radical and stringent international legal instruments, establishing minimum patent standards globally. Through TRIPS, the World Trade Organization (WTO) aims to facilitate intellectual property rights by reducing barriers and irregularities in international trade. Under the TRIPS agreement, microorganisms, microbiological processes, and methods can be patented as industrial designs, thereby turning biological resources into private property. Importantly, TRIPS does not require the disclosure of the origin of biological resources in patent applications. Proponents of this approach argue that such disclosure requirements would impede technological development and innovation. Therefore, while TRIPS provides full protection for the inventor, it does not ensure the protection of benefit-sharing with the holders of the knowledge or resources from which the invention originated [11, 40].

The Nagoya Protocol, adopted in Nagoya, Japan, in 2010 as part of the Convention on Biological Diversity, regulates access to genetic resources and the fair and equitable sharing of the benefits derived from these resources. Consequently, it is regarded as one of the first international legal instruments aimed at preventing biopiracy [12]. Turkey, however, is not a party to this protocol. This underscores the need for international cooperation in the protection of genetic resources, traditional knowledge, and biodiversity, as well as the development of legal mechanisms to safeguard these resources. The primary goal of the Nagoya Protocol is to ensure the sustainable use and conservation of biodiversity by sharing the benefits derived from the use of genetic resources and traditional knowledge. The protocol also ensures transparency and provides a legal framework for states utilizing and supplying genetic resources [13].

Patent policies are well-developed and widespread in Western countries. However, traditional societies in developing countries in the Global South often lack the economic or biotechnological resources required for formal patenting processes. Moreover, their property relations and traditional knowledge-sharing mechanisms are based on solidarity and collective life. In these countries, valuable resources and biodiversity are often viewed as common goods. For instance, farmers who develop new plant varieties can share their knowledge with the community at no cost. As a result, patent applications are not prevalent in these communities, as the concept of patents is either unknown or deemed unnecessary. Consequently, the traditions, cultures, and natural resources of indigenous peoples in developing countries are vulnerable to patenting through intellectual property rights. Thus, biopiracy has become a contentious issue between developed and developing nations [14].

Another factor contributing to the spread of biopiracy is the gap in international law. While intellectual property systems are protected at the national and international levels, an international legal framework specifically designed to address issues such as biopiracy has yet to be established. Biopiracy intersects with various branches of law, including intellectual property rights, property rights, environmental rights, and human rights. Although there are several international declarations and agreements addressing these issues, they are not specifically designed to tackle biopiracy. As a result, contradictory processes persist in the search for rights. Biopiracy, as a problem arising from the sharing of genetic resources between those who provide and those who use them, has been the subject of discussion in various international organizations such as the World Trade Organization (WTO), the World Intellectual Property Organization (WIPO), the Food and Agriculture Organization (FAO), the UNFPA, and the World Health Organization (WHO) since the 1990s. Despite recent developments in the fight against biopiracy, these efforts have represented "progress in theory but difficulties in practice."

**Table 1**. International regulations [9, 10, 39]

| Year | Contract | Relevant Provision |
|---|---|---|
| 1947 | General Agreement on Tariffs and Trade (GATT) | It is a multilateral agreement that regulates international trade in terms of rights and responsibilities. |
| 1961 | Union for the Protection of New Varieties of Plants (UPOV) Convention | According to Article 14, breeders' rights are granted the right to produce or reproduce material, to condition material for the purpose of reproduction, to offer material for sale, to sell material, to import and export material, to stockpile material, and to license material in relation to the propagation of the variety. |
| 1975 | Convention on Trade in Endangered Species (CITES) | Pursuant to Articles 3 and 7, taking the species included in the CITES appendices from their natural habitats and taking them abroad, if not for commercial purposes, is subject to authorization. |
| 1992 | UN Convention on Biological Diversity (CBD) | According to Article 15, access to genetic resources, and collection of samples containing genetic material from nature are subject to authorization. |
| 1994 | Trade-Related Intellectual Property Rights Agreement (TRIPS) | 27 (b), the exceptions to patentable inventions are "plants and animals other than microorganisms and biological procedures relating to the production of plants or animals other than essentially non-biological and microbiological procedures" |
| 2003 | Cartagena Protocol on Biosafety | Article 2 provides in general terms that Parties shall ensure that the development, treatment, handling, transport, transfer, use, and release into the environment of any modified living organisms are carried out in such a manner as to avoid or reduce risks to biological diversity, taking into account the risks to human health. |
| 2004 | International Agreement on Plant Genetic Resources for Food and Agriculture (FAO) | Under Article 10, access to genetic resources for agricultural and food plants is subject to authorization. |
| 2010 | UN Nagoya Protocol | Article 1 aims at equal and fair sharing of the benefits arising from the utilization of genetic resources, sustainable use of biodiversity, and conservation. |
| 2024 | WIPO Treaty on Intellectual Property, Genetic Resources and Related Traditional Knowledge | The objectives of this Treaty are to (a) enhance the efficacy, transparency and quality of the patent system with regard to genetic resources and traditional knowledge associated with genetic resources, and (b) prevent patents from being granted erroneously for inventions that are not novel or inventive with regard to genetic resources and traditional knowledge associated with genetic resources. |

In addition to international regulations, certain developed countries' domestic regulations also pave the way for biopiracy. The effects of US patent law are particularly significant in this context [3]. Indigenous peoples face significant challenges in meeting patent law requirements. First, the innovation requirement is difficult to satisfy because it is challenging to identify the true inventor, given that traditional knowledge is collective. Second, indigenous knowledge does not meet the openness requirement, as it is based on oral tradition rather than written sources, and thus is often regarded as unscientific. When pharmaceutical companies scientifically identify the components of a plant, the company is credited as the inventor, even though indigenous communities have long known where and how the plant was grown and its uses. Third, indigenous peoples do not meet the benefit requirement because they do not seek to profit from the use of the plant or the knowledge associated with it. As a result, they do not fulfill the benefit-sharing requirement [15]. The US patent law significantly impacts international patent standards, as its high level of protection encourages patenting in many countries. The inability of local communities to document their traditional knowledge, combined with strong patent protections, leaves them vulnerable to exploitation by bio-research companies. In fact, the US has allowed the patenting of traditional knowledge from other countries without any compensation to the original knowledge holders [16].

As previously mentioned, biopiracy has been, and continues to be, a critical issue for developing countries rich in biodiversity. These countries often lack biotechnological infrastructure and differ from developed nations in their social, cultural, and governmental structures and their approaches to nature. Consequently, these countries become attractive targets for biological research. Biopiracy activities in these regions are primarily carried out by large multinational companies that dominate the pharmaceutical, agriculture, and food industries. Today, biological resources and the related traditional knowledge they embody are both commercial commodities and crucial sources of research and develop-

ment (R&D) for these companies. For example, in the past 30 years, 26 percent of approved medicines have been developed from natural products or elements derived from nature [11]. The R&D efforts and costs involved make it attractive for companies to capture, through patents and intellectual property, the ready knowledge and resources that indigenous peoples possess, without compensating them.

The issue of biopiracy does not seem to be easily solvable under current conditions, given its multifaceted nature. First, patenting conditions vary from country to country, and these conditions involve diverse concepts and techniques. Second, technical concepts related to traditional knowledge differ across countries. Third, the concept of biopiracy is not clearly defined in international agreements. Fourth, no established compensation mechanism exists for biopiracy, and a comprehensive control system has not yet been developed. Fifth, intellectual property and patent laws in developing countries are still underdeveloped and weak compared to the Western system. Due to these challenges, several key questions remain unresolved: Should traditional knowledge based on biodiversity be shared with bio-research companies? Should patents derived from such knowledge be rejected? Regardless, the importance of strict protection of traditional knowledge or genetic resources to prevent biopiracy is emphasized, and limiting their use to certain discoveries in the public interest is also suggested. The high cost of researching useful components in millions of plant varieties further incentivizes multinational companies to exploit ready, experienced traditional knowledge through patents at minimal cost. If traditional knowledge and genetic resources are not protected, the rights of the original holders of these resources are lost. The sustainability of biodiversity, genetic diversity, and the survival of future generations depend on the protection of these resources. In indigenous communities, biodiversity is closely tied to cultural diversity [17]. Gebara et al. (2023) define the concept of bioepistemics as the deliberate erasure and trivialization of indigenous/traditional knowledge, a process facilitated by external actors through biocolonialism. Bioepistemics highlights the consequences of cultural destruction, which includes the loss of traditional knowledge and practices vital for sustainable relationships with the natural world, as well as the suppression of alternative knowledge systems that challenge prevailing Western paradigms [18]. Simultaneously, traditional knowledge is the product of cultural accumulation passed down through generations. Without benefit-sharing from biological resources, natural resources are priced cheaply in the market through patents held by chemical and agricultural companies, preventing production based on local-traditional knowledge and causing economic losses. The fact that in many developing countries farming is not simply a business but a way of life should be highlighted. For instance it is estimated about 60 percent of the population in India are engaged in agriculture. Hence many livelihoods could be harmed without proper regard to farmer's rights in patenting of plant varieties [40]. For example, patents for plants such as sambo, lagundi, and ampalaya, used by indigenous communities in the Philippines, are held in industrialized countries such as the USA, Japan, and the UK. As a result, indigenous peoples are deprived of these plants, and biodiversity is threatened, as cultivation becomes difficult [4]. Thus, cultural, economic, and ecological losses may arise due to biopiracy. Merson (2000) argues that combining mechanisms to protect our biodiversity with the legitimate interests of societies in using their genetic wealth is an issue to be challenged in courts and legislatures [38].

## BIOPIRACY PROBLEM AND POLICIES IN THE WORLD

Among the countries that are exposed to biopiracy and have naturally developed certain policies in this regard, India and Peru have a leading role. India is one of the countries with the richest biodiversity in the world. On the other hand, India is also rich in traditional knowledge, which has been passed down from generation to generation for centuries. Traditional knowledge is vital for people's livelihood, especially in rural areas. Due to all these riches, it is one of the first and most exposed countries to biopiracy. India, being one of the first countries to be exposed to biopiracy, has carried out original studies in the field of management and law to address the problem in question. Peru, as a South American country, is a country with high biodiversity in hotspots. Peru has set an example in the world with the organization it has established due to the transformation of its traditional knowledge into intellectual property through intellectual property and patents [19].

Other countries have also developed important policy instruments against biopiracy in the international arena. In these countries, the development of a "sui generis regime" to prevent the use of traditional or indigenous knowledge in patent processes has come to the fore. Countries such as Panama, Brazil, and the Philippines are managing this process well. Panama is one of the first countries to enact a collective rights regime to recognize and protect the cultural identity of Indigenous peoples' traditional knowledge. On the other hand, Panama is one of the countries that makes the best use of the legal system to protect the human rights and traditional knowledge of indigenous people. Panama has registered and protected the traditional knowledge of the Kuna ethnic community, which they call "Mola". In this way, the intellectual property and collective traditional knowledge rights of Indigenous communities, such as inventions, designs, innovations, etc., are protected, and protection against unauthorized commercialization and exploitation is provided. According to the law adopted in 2000, if traditional knowledge and cultural expressions are registered, the trade of traditional knowledge and cultural expressions will be prohibited without the permission of indigenous authorities [20].

Costa Rica's National Biodiversity Institute (INBIO) signed a biological research agreement with a pharmaceutical company, sharing the benefits of the commercial use of biological materials. This agreement promotes the sustainable use of local biological resources while also providing economic benefits [21]. The Philippines government also enacted a law on the rights of indigenous peoples in 1997. Therefore,

the sui generis regime is expected to bridge the legal system between local communities and the national-international level to effectively protect the rights of Indigenous people. Andean countries such as Colombia, Ecuador, Peru, Bolivia, and Venezuela have adopted laws and measures regulating access to genetic resources [12].

Apart from the sui generis regime, one of the methods proposed against biopiracy in the world is the "Digital Library of Traditional Knowledge." This library is an Indian database based on the categorization of practical drug-treatment knowledge by collecting data electronically. The aim of the database is to prevent biopiracy of traditional knowledge and to detect unauthorized patent applications. This system is a pioneering practice in the world in terms of protecting traditional knowledge. The library database is scanned by global patent offices related to traditional knowledge in patent application processes. As a result of these scans, patent experts will be able to make easy and appropriate decisions about patents. As a matter of fact, through this system, which does not require any cost, more than 230 patent applications were withdrawn in India in a short period of time [22]. The traditional knowledge system is not in line with Western patent criteria. Since traditional knowledge is based on word-of-mouth communication, it is seen as a common right. Therefore, Western patent experts find it difficult to understand and identify traditional knowledge in patent processes [19]. Therefore, the database in India is also very important in terms of defining traditional knowledge. The table below lists a few examples where India has encountered biopiracy and successfully revoked patents.

**Table 2**. Global biopiracy incidents with details [23]

| Incident | Country of origin | Pirated country |
|---|---|---|
| Karawila | South Asian countries including Sri Lanka | USA |
| Magul Karanda | Sri Lanka | Japan |
| Neem | India Nepal | EPO to US Department of Agriculture and the USAmerican firm W.R |
| Enola Bean | Mexico | USA |
| Hoodia plant | Southern Africa | CSIR gave patent to Phytopharm and Pfizer |
| Kakadu Plum | Australian Aboriginal people | USA |
| Masbadda | Sri Lanka | Japan |

The third approach to protect traditional knowledge and biodiversity against biopiracy is "geographical indication and disclosure of the original genetic/biological source". In this system, disclosure of the original source data is required to investigate the inadequacy of the patent application proposed by the international community to protect traditional knowledge and genetic resources. Several developing countries question the original genetic source in patent conditions. In 2004, India and Brazil expressed in various international meetings that the origin of the genetic resource should be disclosed in patent applications, that such a provision should be introduced for TRIPS, and that it should be a requirement [19].

The ideal approach to biopiracy is to establish win-win policies based on cooperation between developed and developing countries. Due to the costly and limited results of establishing a database system, bio-research agreements are becoming an alternative policy. Such agreements are based on negotiation and compromise between research companies and communities with traditional knowledge. Local communities are usually paid a fee, and initially, royalties are negotiated. The most famous research agreement is the one between the Costa Rican government and the US pharmaceutical company Merck. The pharmaceutical company agreed to transfer technology, provide equipment, and pay royalties if any drugs were discovered. The Costa Rican government agreed to provide tens of thousands of plant and animal germplasm samples from indigenous and government sources [8].

## CURRENT SITUATION AND POLICIES IN TURKEY IN TERMS OF BIOPIRACY

### Turkey's Risk of Exposure to Biopiracy

Turkey is a country with significant biodiversity. Its geographical location places it at the intersection of three different continents—Europe, Asia, and Africa—resulting in a wide range of ecosystems, including forest, mountain, steppe, wetland, coastal, and marine environments. These ecosystems reflect varying influences from the distinct characteristics of each of these continents. Turkey has the richest biodiversity in Europe and the Middle East, encompassing some of the world's most important ecological regions, both in terms of flora and fauna. Turkey's ecosystem is characterized by high levels of endemism and genetic diversity [24]. Approximately 33% of plant species in Turkey are endemic [25]. The country is also well known for its role in the international flower bulb trade, hosting over 500 bulbous plant species, including snowdrops, snowflowers, cyclamens, tulips, and crocuses. Its flora includes over 9,000 plant species, approximately 3,000 of which are endemic. In addition to this, Turkey's flora is rich in medicinal and aromatic plants. Moreover, Turkey is located at the crossroads of two major Vavilovian gene centers: the Mediterranean and the Near

East, both of which play a critical role in the origin of cereals and horticultural crops. Turkey is also home to five microgene centers. Over the past three decades, 256 varieties of cereal genes have been identified, including 95 varieties of wheat, 91 of maize, 22 of barley, 19 of rice, 16 of sorghum, 11 of oats, and 2 of rye. For horticultural crops, it is estimated that there are around 200 crops, encompassing approximately 50 genera and 100 species, both cultivated and distributed, along with local and foreign varieties. Regarding fruit species, 80 are represented. Anatolia, which is also home to wild grapevine species, is recognized as a gene center for the grapevine [24].

In addition to its rich biodiversity, Turkey also possesses a wealth of traditional knowledge. Many folk remedies, passed down through generations, have been used in Anatolia for thousands of years. For instance, pine cones were historically used in the treatment of stomach ailments, and the Hittites created medicines from olive trees over 4,000 years ago. While modern medicine discovered aspirin in the 19th century, folk remedies for treating festering wounds using willow trees have been practiced in Anatolia for centuries [26]. With the rise of certain incurable diseases, traditional herbal mixtures and treatments have also been adopted by Western-trained scientists and physicians [27].

Due to its biodiversity and rich traditional knowledge, Turkey is vulnerable to biopiracy. Several factors increase the risk of biopiracy in the country. One key factor is Turkey's geographical proximity to developed European countries, coupled with its accessibility on the global stage. Furthermore, the insufficient documentation of biodiversity and traditional knowledge in Turkey exacerbates the situation. Additionally, it is known that Turkey has been subjected to international smuggling, particularly related to biological trade, biotechnology, genetic studies, the health and cosmetics industry, as well as animal collecting, hunting, and scientific research [28].

Despite the significant risks, biopiracy is not explicitly defined in Turkey's legislation. In scientific studies and official reports, biopiracy is often referred to as the trafficking of genetic or biological resources. While the concept of biopiracy is not formally codified in Turkish law, reports from the Special Expertise Commission on Intellectual Property highlight its connection to intellectual property rights, patents, and the registration and protection of traditional knowledge and genetic resources against exploitation by foreign researchers. In response to this issue, efforts are underway in Turkey to establish protective policies. For instance, Article 90 of the Industrial Property Law No. 6769, adopted in 2016, mandates that "if an invention is based on genetic resources or traditional knowledge related to genetic resources, the source of these resources must be disclosed in patent applications." Although progress has been made in addressing the relationship between biopiracy and intellectual property, it can be argued that further steps are needed to effectively identify and prevent instances of biopiracy.

**Biopiracy Problem in Turkey**

Although there have been no identified cases of biopiracy subject to international lawsuits in Turkey, this does not imply that biopiracy does not occur within the country. The detection of biopiracy cases and the effective combat against them are closely linked to the scientific documentation and registration of biological, genetic, and traditional knowledge resources in the country. In Turkey, it cannot be said that the scientific, administrative, and legal studies, preparations, and infrastructures related to this issue are sufficient. On the other hand, the problems identified within the scope of biopiracy in the country are predominantly related to "biopiracy" itself.

Biopiracy, which refers to the unauthorized collection of wild organisms and their parts from nature and their illegal export, is most frequently directed towards bulbous plant species in Turkey. Species such as the inverted tulip, weeping bride (Fritillaria), tulip (Tulipa), snowdrop (Galanthus), narcissus (Narcissus), daffodil (Narcissus), buckthorn, yersomone species, Arabian hyacinth (Muscari), iris, wolf's ear (Iris), and lily (Lilium), as well as mountain tulips and Manisa tulips (Anemone) are among the primary species targeted for illegal smuggling [29]. Medicinal and aromatic plants rank second, followed by butterflies as part of the fauna. Among reptiles, the Caucasian (Hopa) viper, Baran viper, large viper, lizard species, medicinal leeches, and various insect species are also targeted.

The homeland of the reverse tulip, for example, is in the Van and Hakkari regions of Turkey. This bulbous plant is on the verge of extinction, yet the Netherlands imports reverse tulip bulbs from Turkey and exports them worldwide. Over the past century, eight naturally occurring plant species have disappeared from Turkey, while 46 species, including cyclamen, wild tulip, iris, lily, snowdrop, and crocus, are under threat. Studies indicate that 183 species have been damaged due to excessive collection [30].

Countries that have successfully implemented policies against biopiracy often identify patents in other countries related to their genetic and biological resources and counteract them with lawsuits. In Turkey, however, efforts are still limited to addressing biopiracy, and thus, the policies and institutions that have been developed are focused primarily on this issue. The General Directorate of Nature Conservation and National Parks (DKMP) is the most authoritative institution in Turkey regarding this matter. According to DKMP data, between 2007 and 2013, 49 smuggling incidents were recorded, with 6 incidents detected in 2014, 8 in 2015, 4 in 2016, 3 in 2017, 1 in 2018, 8 in 2019, 1 in 2020, and 2 in 2021. Moreover, it has been determined that 4,497 species found in Turkey are included in American, European, and international patent applications [31]. Some studies suggest that the number of biotrafficking cases in Turkey is much higher than the officially detected incidents, and these occurrences often proceed "imperceptibly" [32].

In the cases detected so far, it has been found that biotrafficking attempts in Turkey are carried out by nationals from Syria, Japan, Russia, and Germany. These individuals have been caught at border gates and in vehicles, transporting insect or butterfly species that they had collected without au-

thorization. Biotrafficking in Turkey is not only perpetrated by foreign nationals; in some instances, Turkish citizens are also consciously or unconsciously involved. The DKMP has identified 13 such cases. Furthermore, Turkish academics may inadvertently send local biological and genetic materials abroad during research collaborations with foreign researchers. This issue arises from the inadequacy of the technological infrastructure in Turkey for conducting research on these materials, and ultimately leads to outcomes similar to biological trafficking. Additionally, unconscious biopiracy incidents occur when local individuals collect natural resources and hand them over to foreigners with the intention of offering assistance, without realizing the implications.

As part of the project initiated in 2013 to combat biotrafficking, the DKMP has developed tools for on-site detection of biotrafficking incidents and the apprehension of perpetrators. The DKMP organizes public service announcements, seminars, and events aimed at raising awareness about biodiversity, genetic diversity, and endemic species in relation to ecosystems. According to DKMP data, administrative fines were imposed on 134 foreigners from 21 different countries for involvement in 79 incidents between 2007 and 2019. The "Anti-Biotrafficking Information System" was also established to share biotrafficking data between law enforcement agencies and the Ministry of Agriculture and Forestry, ensuring the follow-up of incidents. Information within this system can be transferred to law enforcement units through a dedicated line provided by the ministry, under a protocol with the Ministry of the Interior.

To date, biotrafficking incidents in Turkey have been detected through searches of researchers or individuals, or through public complaints about suspicious behavior. However, preventive systems such as the "patent screening system" have not yet been developed. In Turkey, biotrafficking is often carried out by smuggling species between books, in special compartments in vehicles, or by concealing them on individuals' bodies. The lack of deterrent penalties in Turkey, combined with the country's rich biological diversity, heightens the potential for biosmuggling. The market value of some species is many times higher than the administrative fine imposed when they are caught smuggling. This is evident from the statements made by some foreigners caught in biotrafficking cases in Turkey, such as "I have been taking plants/animals for years; why are you holding me now, what's going on?" which highlights the inadequacy of preventive measures in the country [33]. Reptiles and snakes, which are valuable species in Turkey, are often smuggled abroad. For example, if a Caucasian viper is caught being smuggled, it may incur a fine of 35,000, but it sells abroad for up to 125,000 dollars. This creates a situation where the perpetrator may not care about paying the fine, as there is no imprisonment penalty, and they are released after paying the fine, which does not prevent further smuggling [34].

Administrative fines imposed for smuggling offenses in Turkey may not be sufficient deterrents for researchers. Furthermore, because trafficking is classified as a "misdemeanor" rather than a "crime" under Turkish law, it encourages such incidents.

In practice, both local and foreign researchers apply to the relevant ministry to collect and examine a limited number of species with appropriate authorization documents. During the research, the amount collected must not exceed the approved quantity, and the samples cannot be taken abroad without the approval of the DKMP. Researchers are required to inform the directorate of any work to be conducted before and during fieldwork. The "Biodiversity Research Permits Information System and Database" was established within the DKMP to regulate scientific research on biological diversity and to store results in a manner that generates public interest. Consequently, regulations do not permit research processes without the necessary documentation, and these measures are intended to prevent biopiracy. However, despite these regulations, it has been claimed that in some biopiracy incidents, with the support of local researchers, foreign researchers have had the opportunity to identify and examine unauthorized species. Since domestic and foreign researchers follow different procedures in scientific research, foreigners may exploit domestic researchers in their research processes. Additionally, domestic researchers face challenges related to time and bureaucracy, which may contribute to plant exports abroad through international collaborations and projects [35].

As a result, the policies on biopiracy in Turkey are largely confined to detecting the unauthorized collection and smuggling of species. Once species are smuggled abroad, they are not pursued, and the issue is only addressed within the national borders. While not all cases of biopiracy are necessarily motivated by intellectual property and commercial gain, they still need to be tracked both domestically and internationally.

**Policies Produced Against Biopiracy in Turkey**

The issue of biopiracy is perceived as a comprehensive problem in national action plans. To prevent biological smuggling, a permit and control system has been targeted, aiming to ensure that the application, permit, control, and inspection mechanisms for activities related to biological resources by foreigners in Turkey are carried out in a coordinated manner both within and between institutions. In order to detect trafficking at the exit gates abroad, arrangements are planned to assign technical personnel at designated border gates and to make necessary adjustments for the existing teams responsible for protection and control duties in the field to be able to work on combating trafficking. The Ministry of Agriculture and Forestry is the primary responsible organization, followed by the Ministry of Environment, Urbanization and Climate Change, Ministry of Culture and Tourism, Ministry of Interior, Ministry of Foreign Affairs, Ministry of Trade, Ministry of Industry and Technology (Turkish Patent and Trademark Office), and Ministry of Health. On the other hand, the basic legislation concerning biopiracy consists of the following laws. The table below shows that numerous laws are related to biopiracy in our country. However, although there is no comprehensive framework law, institutional conflicts may arise in this area.

**Table 3**. Laws related to biopiracy [7]

| Year | Contract | Relevant Provision |
|---|---|---|
| 1956 | Forest Law No. 6831 | Ministry of Agriculture and Forestry |
| 1971 | Law No. 1380 on Fisheries | Ministry of Agriculture and Forestry |
| 1983 | Environmental Law No. 2872 | Ministry of Environment and Urbanisation |
| 1983 | Law No. 2873 on National Parks | Ministry of Agriculture and Forestry |
| 1983 | Law No. 2863 on the Protection of Cultural and Natural Heritage | Ministry of Culture and Tourism |
| 1999 | Customs Law No 4458 | Ministry of Trade |
| 1995 | National Afforestation and Erosion Control Mobilisation Law No. 4122 | Ministry of Agriculture and Forestry |
| 2003 | Law No. 4915 on Land Hunting | Ministry of Agriculture and Forestry |
| 2004 | Law on the Protection of Breeders' Rights to New Plant Varieties | Ministry of Agriculture and Forestry |
| 2006 | Seed Law No. 5553 | Ministry of Agriculture and Forestry |
| 2006 | Law No. 5488 on Agriculture | Ministry of Agriculture and Forestry |
| 2007 | Anti-Smuggling Law No. 5067 | Ministry of Interior |
| 2010 | Biosafety Law | Ministry of Agriculture and Forestry |
| 2010 | Law No. 5996 on Veterinary Services, Plant Health, Food and Feed | Ministry of Agriculture and Forestry |
| 2010 | Law No. 5977 on Biosafety | Ministry of Agriculture and Forestry |

In addition to the table presented, the Industrial Property Law (2016) is one of the fundamental legal frameworks regarding the relationship between biopiracy and intellectual property. Amendments have been made to this law that require patent applicants to "disclose the origin of the resources used in their inventions based on traditional knowledge related to genetic resources." The Action Plan for Combating Biotrafficking, prepared in 2015, aims to review the legislation, institutional arrangements, identification, control, information dissemination, and awareness-raising mechanisms for combating trafficking, while identifying the existing needs. The action plan has three primary objectives: establishing a legal and institutional framework for combating trafficking, addressing the technical requirements for detecting trafficking, and raising awareness of the issue. As part of the legal and institutional arrangements component of the Action Plan, the "Anti-Biotrafficking Information System" was established to facilitate the monitoring of biotrafficking cases [30].

On the other hand, the Ministry of Agriculture and Forestry, which is directly responsible for formulating policies to address the issue of biopiracy, has been actively involved in recording traditional knowledge related to biodiversity. In this context, the Minister at the time stated the following [36]:

"Under the motto 'From Tradition to the Future,' we launched the Biodiversity-Based Traditional Knowledge Recording Project in 2017 to safeguard our rights to traditional knowledge associated with our genetic resources. The aim of the project is to compile information on traditional products, such as medicines, yeast, and paints, developed by our people using natural biological resources. In 2020, we completed the project in 21 provinces and recorded over 20,000 traditional biological data entries. By the end of 2023, we intend to complete the project across all 81 provinces and document a significant portion of traditional knowledge based on biodiversity. Through this initiative, we aim to further integrate our biological diversity into the economy, allowing our country to benefit more from industrial property rights based on our genetic resources. We are documenting all the information we collect in the National Traditional Knowledge Management System."

As a result, it is evident that studies capable of providing evidence for industrial property rights against biopiracy have begun in Turkey, and a policy-making process is actively underway in this regard. Karagöz et al. (2010) emphasize the importance of international regulations that will ensure fair and equitable benefit-sharing for the economic use and sustainability of biodiversity, noting that Turkey is currently excluded from this benefit-sharing framework under the patentability of living organisms and their parts, and is among the countries that exploit these resources [35]:

"In recent years, significant research has been conducted in Turkey focused on the search for and discovery of plant genetic resources. However, the majority of studies carried out in our universities only involve identifying plants and storing the information and materials obtained. Several departments across different universities often work on the same plants in overlapping research areas. Unfortunately, the skill to convert these discoveries into economic value is not fully realized. The most significant contribution from these resources could come from extracting and utilizing genes linked to economically important traits. The potential profits from using these genes directly in our products or by selling them for patent rights could be substantial, considering the wealth of plant gene resources available in our country."

It is crucial to acknowledge that the most problematic aspect of biopiracy concerns the acquisition of intellectual property rights and patenting. Biopiracy involves the unjustified appropriation of traditional knowledge and genetic/biological resources without any compensation. Consequently, biopiracy in Turkey should not be confined to the unauthorized export of species; the international dimension of this issue must also be addressed. Unfortunately, Turkey has yet to pursue any rights at the international legal level regarding patents or intellectual property rights based on biopiracy. While many developing countries are actively addressing this issue on the international stage, it is insufficient for Turkey to tackle the problem solely within its national borders.

## CONCLUSIONS

Countries such as India and Peru, which were among the first to experience biopiracy, have approached the fight against this issue comprehensively and established relevant public institutions. In these countries, non-governmental organizations have also played an active role in raising public awareness about biopiracy. These nations enacted biodiversity legislation at an early stage, aiming to protect traditional knowledge and biodiversity. They have closely monitored the unauthorized patenting of their resources by other countries and corporations, operating within the framework of international cooperation and establishing institutional structures with the necessary technical and financial resources. As a result, these countries have taken successful and exemplary steps in combating biopiracy.

In contrast to the international approach, the issue of biopiracy in Turkey is perceived primarily as biosmuggling. This reductionist perception has shaped both legislation and policy-making processes, thereby limiting the capacity to address a multidimensional problem such as biopiracy. When examining the relevant legislation and policies, it is evident that the first dimension of biopiracy is primarily focused on species theft. Policies related to benefit-sharing and the protection of intellectual property rights at the international level remain weak. In this context, it is essential to identify commercial products that utilize genetic resources, as well as molecular biological and biotechnology-developed resources as raw materials, in cooperation with the Turkish Patent and Trademark Office (TPMK). It is crucial for TPMK to establish agreements with the patent offices of countries with high patent activity, such as the USA, Japan, the UK, Russia, and Germany, in order to identify biological resources, as India has done. Additionally, a screening method should be implemented to trace the origin of resources, thus protecting genetic and biological resources as well as traditional knowledge before granting patents.

In Turkey, work is ongoing at the ministry level to preserve traditional knowledge through the creation of a data inventory. However, there is a risk that the number of elderly individuals, who are the primary holders of this knowledge, will gradually decrease. The fact that this project only commenced in 2018 exacerbates this risk. Therefore, it is essential to expedite the process of collecting and documenting collective knowledge and data. In this regard, both central and local governments, as well as non-governmental organizations, should work collaboratively to access and record traditional knowledge without delay, ensuring that it is not included in intellectual property rights. Legislative efforts concerning "benefit-sharing," which is a crucial step in preventing biopiracy in Turkey, are still ongoing and have not yet been finalized. Furthermore, Turkey has yet to establish a direct institutional structure, such as the Commission for Combating Biopiracy in Peru. Additionally, there are no legal instruments in Turkey to protect traditional knowledge related to biodiversity. Given these shortcomings, there is an urgent need to analyze the institutions and policies in leading countries and carry out the necessary studies without further delay.

## DATA AVAILABILITY STATEMENT

This study was produced from the doctoral thesis defended by Erdal GÜLER in the Department of Public Administration at Ondokuz Mayıs University Graduate Education Institute in 2022. The authors confirm that the data that supports the findings of this study are available within the article. Raw data that support the finding of this study are available from the corresponding author, upon reasonable request.

## CONFLICT OF INTEREST

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## USE OF AI FOR WRITING ASSISTANCE

Not declared.

## ETHICS

There are no ethical issues with the publication of this manuscript.

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