



*Biodiversity In The Patent System:
A country study of biodiversity, genetic resources
and global patent activity for the Republic of Congo*

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Introduction

This report presents the results of analysis of patent activity for genetic resources and traditional knowledge from the Republic Of Congo. The report is divided into three sections:

Section 1 provides an overview of biodiversity in the Republic Of Congo based on information from the Global Biodiversity Information Facility and introduces the patent data.

Section 2 provides a general overview of patent activity for species known to occur in the Republic Of Congo in the period 1976-2010. This is followed by detailed analysis of patent documents that make reference to the Republic Of Congo and data based on species that are limited to distribution in the Republic Of Congo

Section 3 provides a set of short summaries for species that are a focus of patent activity. This information will also be made available online for further research through the Access and Benefit Sharing Patent Index (ABSPAT).¹

The report was prepared using large scale text mining of patent data for species names and country names. This data was then combined with taxonomic information from the Global Biodiversity Information Facility. Additional patent research was conducted using the commercial Thomson Innovation database and processed using a variety of software tools.

Patents are an important indicator of investments in research and development directed to the development of commercial products. The aim of the report is to identify potential opportunities for economic development in support of conservation by identifying existing research and development involving species from the Republic Of Congo. The research did not investigate the terms and conditions under which patent applicants obtained the genetic resources and traditional knowledge disclosed in the patent document. Therefore the report does not consider the problem of biopiracy or misappropriation of genetic resources and traditional knowledge.

The research was initially limited to searches of patent data from the United States, the European Patent Office and the international Patent Cooperation Treaty in the period 1976-2010. Additional research was performed to identify and review patent documents making reference to Congo in general published anywhere in the world between 1900 and 2013. As such the report provides a baseline for patent activity involving species from the Republic Of Congo as a basis for further research.

Our research focused primarily on documents that make reference to the Republic Of Congo and to cases where existing distribution data suggests the Republic Of Congo is a likely source for the species. This imposes two limitations on the research. First, we focus on identifying species that are a focus of existing research and development. However, the report does not seek to provide the complete global patent landscape for an individual species. Second, because we focused on identifying species from a country we did not search patent data for references to regions (i.e. Africa) or sub-regions (i.e. Southern

¹ ABSPAT is available at <http://www.abspat.net>

Africa) in the patent data. To address this issue we deliberately highlight cases where a species is distributed in more than one African country.

This report is one in a series of reports on patent activity for species from African countries. The following observations are based on the research for the fifteen African country reports to date and form the main recommendations arising from the research.

Taxonomic Research:

1. There is a need to improve the availability of taxonomic information for each country. In the absence of taxonomic information it is not possible to identify genetic resources that are relevant to a particular country in patent data and any relevant opportunities for economic development. African countries could consider giving greater priority to taxonomic research and making taxonomic information available through GBIF.
2. Georeferencing of the coordinates for the locations of species is an important standard in modern biodiversity research. Georeference data can be used to identify where species have been recorded in a country and also where biodiversity research has been concentrated. In our view georeferencing is an under-utilised tool for identifying where species are located as a basis for engaging with indigenous and local communities to consider potential development opportunities. We recommend greater attention to georeferencing and its use for engagement with relevant indigenous and local communities.
3. Taxonomic research does not attract investment because it appears to be remote from economic considerations. In practice taxonomic information is vital to identifying opportunities for development that is supportive of the objectives of the Convention on Biological Diversity and its Nagoya Protocol.
4. Taxonomic information is also important for the capacity of countries to monitor compliance with the Nagoya Protocol by improving baseline data on the species within a country. Advancing knowledge and understanding of biodiversity and the traditional knowledge of indigenous and local communities has an important role to play in long term monitoring under the Nagoya Protocol.

The Patent System:

1. Patent documents are frequently unclear on the precise origin or source of genetic resources and associated traditional knowledge. In addition very limited information is available on the terms and conditions of acquisition of genetic resources and traditional knowledge. This could be improved through enhanced disclosure of origin measures as advanced by the African Group and discussed in greater detail elsewhere;²
2. Species are commonly distributed in more than one country. It is important that African countries include requirements in access and benefit sharing agreements to clearly specify the source of genetic resources and associated traditional knowledge in any patent applications that may arise under the terms of an agreement. When combined with the enhanced disclosure measures noted above this would greatly improve capacity to monitor patent activity under the terms of the Nagoya Protocol;
3. One of the major issues that emerged in the research is the problem of essential incorporation of species into patent claims. Patent applicants frequently list very large numbers of species, or make reference to genera and families, with the purpose of incorporating all members of a genus or family into the scope of the patent claims. Typically these applications did not involve collection or use of many of the species that

² Oldham, P & Burton G (2010) *Defusing Disclosure in Patent Applications*. UNEP/CBD/COP/10/INF/44

are listed. The aim of essential incorporation is to prevent others from using compounds, extracts or ingredients from these species in similar inventions or products. Where granted these patents are likely to have negative consequences for researchers and producers in African countries seeking to develop and export similar products from these species. In our view, patent claims for components of organisms should be limited to the species from which the compound or extract was isolated by the applicants and not extend to members of the genus or entire families. Furthermore, in our view essential incorporation is anticompetitive and action should be considered to stop or severely restrict this practice.

4. In some cases patent activity may involve species that are vulnerable, endangered or CITES listed. In considering the possibilities for economic development identified in patent data it is also important to identify and assess the conservation status of the species concerned in order to support the objectives of the Convention on Biological Diversity.

Patents have frequently been viewed with suspicion within the biodiversity policy community as examples of the inequitable exploitation of resources from biodiversity rich developing countries. Our research demonstrates that patent data can also be turned to positive purposes to identify potential opportunities for economic development in Africa. We hope that this information will prove to be useful to African countries.

Republic of Congo

Area:

342,000 sq. km.

Coastline:

169 km

Climate:

Tropical with one rainy season and one dry season and consistently high temperatures.

Geography:

The Republic of Congo comprises a coastal plain with a southern basin, a central plateau and a northern basin.



Biodiversity in Republic of Congo and Patent Activity:

Data for biological diversity was obtained from the Global Biodiversity Information Facility (GBIF). GBIF is an international government-initiated resource that provides open access to the most comprehensive quantitative data of species across time and space presently available. All data is submitted by participants who share biodiversity information.

Using this resource we have obtained biodiversity records for species which occur in the Republic of Congo. It should be noted that the usefulness of this data in determining the actual distribution of a given species is conditional to the comprehensiveness of the data submitted by GBIF participants. Therefore we would stress that the absence of records should not be interpreted as indicating an absence of a given species, and similarly that a recorded species that only appears from one country should not be regarded as evidence of endemism. All reasonable efforts in identifying endemic species were made from alternative sources during the compilation of this report.

GBIF presently records 5,813 species for the Republic of Congo with 7,603 georeferenced coordinates for the occurrences of these species in the Republic of Congo.

We identified a total of 119,286 documents containing species known to be distributed in the Republic of Congo. Of these 74 made some form of reference to the Republic of Congo. These documents were manually reviewed in MAXQDA software to identify documents specifying a source or origin in the Republic of Congo.

The 74 documents that made a specific reference to the Republic of Congo contained eight species. These documents were manually reviewed in MAXQDA data analysis software and through this process we were able to identify species where it was definitively stated that they had been collected, sampled or otherwise obtained from the Republic of Congo.

In addition, using GBIF distribution data we identified twelve species where GBIF presently records distribution only in the Republic of Congo. These species appeared in 132 patent documents where the Republic of Congo was not explicitly mentioned. The idea behind this was to identify cases where a species (based on available distribution data) was likely to have come from the Republic of Congo and thus be regarded as a species of likely or potential significance for the Republic of Congo. For the sake of simplicity we call this data 'Distribution 1'. These documents were then selected for further review.

Finally, we carried out an additional search across all global patent jurisdictions for any documents making reference to the term Congo published between 1900 and 2013. This search identified 10,902 raw documents with 3,583 documents containing species references which were manually reviewed using MAXQDA software. This data proved to be exceptionally noisy and did not yield meaningful results beyond those already identified.

Biodiversity and Distribution

Much of the data submitted to GBIF includes geographical coordinates indicating where the recorded species was located. A total of 7,603 coordinates were available for the Republic of Congo. Using this data we are able to show the physical distribution across the Republic of Congo of all GBIF recorded species. Plate 1 shows two maps: The upper map shows plotted points, each indicating a GBIF record. The points are coloured to indicate the kingdom to which the species belongs. It should be noted that this geographical information is raw data as submitted to GBIF by participating recorders. It has not been cleaned to remove any human errors when inputting to the GBIF database (an example of such an error might be where a longitudinal coordinate has been recorded as a + rather than a -). The lower map shows major settlements and roads. It also includes the location of some protected areas such as Odzela-Kokoua National Park in the north and Reserve de Faune de Tsoulou in the south - places expected to be of significance for biodiversity. A larger version of the distribution map can be found in the appendix of this country report.

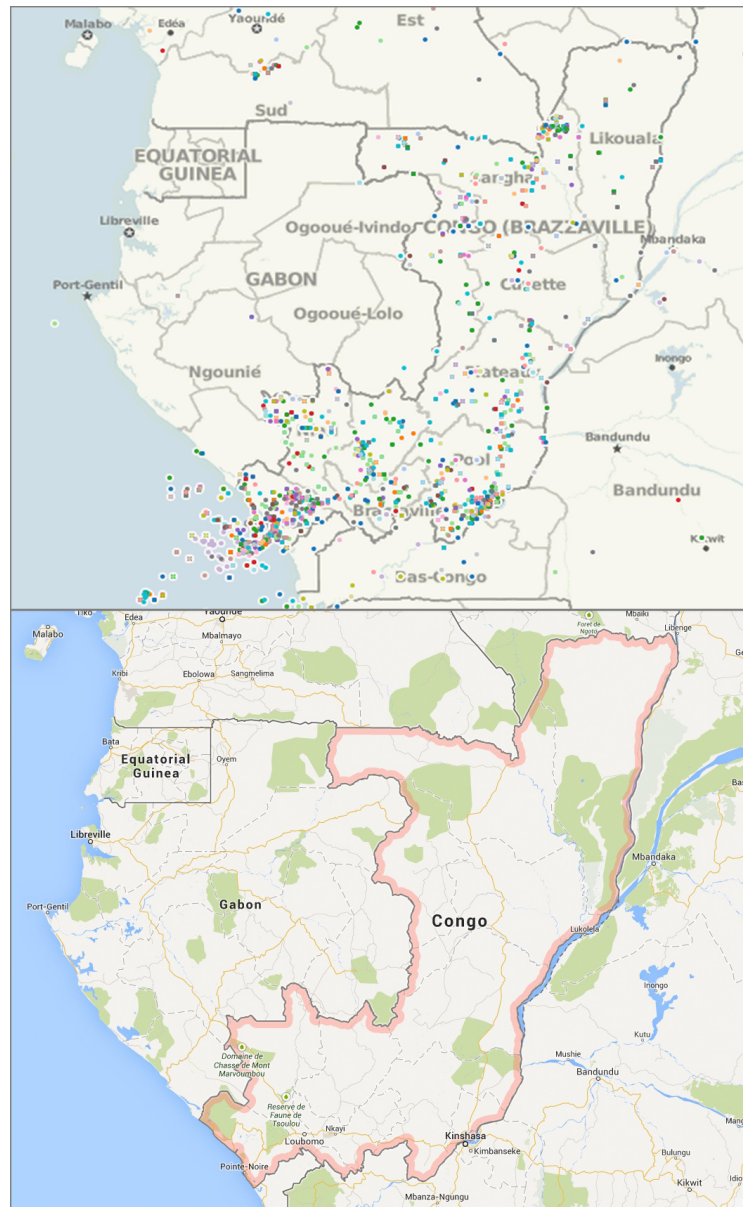


Plate1: Distribution of GBIF records from Republic of Congo (upper) and major settlements and roads (lower) (map courtesy of Google Maps). Each colour point represents a species record coloured by kingdom.

It is interesting to note, when comparing the two maps, that there are distinct hotspots showing areas of more extensive recording. These are primarily in the south between Brazzaville and the coast, and along the coastline itself. The maps also reveal recording of maritime species. This concentration of georeferenced records follows the pattern seen in other African countries in that it appears to be focused around the most populous areas and along road routes, for example the route of the major N2 road, north of Brazzaville which is clearly seen on the distribution map. The other area of density for records is in the Odzala-Kokoua National Reserve in the north, a park managed for conservation of flora and animal species such as the forest elephant and lowland mountain gorilla. The remainder of the country would seem to be very thinly recorded, and again this is a pattern seen in other African countries where more difficult-to-access areas are not well covered. This pattern of records and the relative scarcity of georeferenced locations suggest that some extensive recording has been carried out only in the western populated area and that the rest of the country has considerable potential for further recording to build an accurate picture of the biodiversity and distribution. We would note that georeferencing of

species data has an important role to play in facilitating the identification of where species are located in a country. While caution is required in the case of endangered species we would emphasise the wider importance of promoting georeferencing in enhancing knowledge and understanding of biodiversity in the Republic of Congo.

GBIF presently records 6,012 species known to be present in the Republic of Congo (this figure includes unresolved names, hence the increase in species from the number quoted above). This list is dominated by plants and animals which account for 5,776 species. The remaining 236 records are dominated by fungi and bacteria, but seven kingdoms in total are represented. This suggests that a varied range of recording and collection has been undertaken despite the low number of georeferenced data.

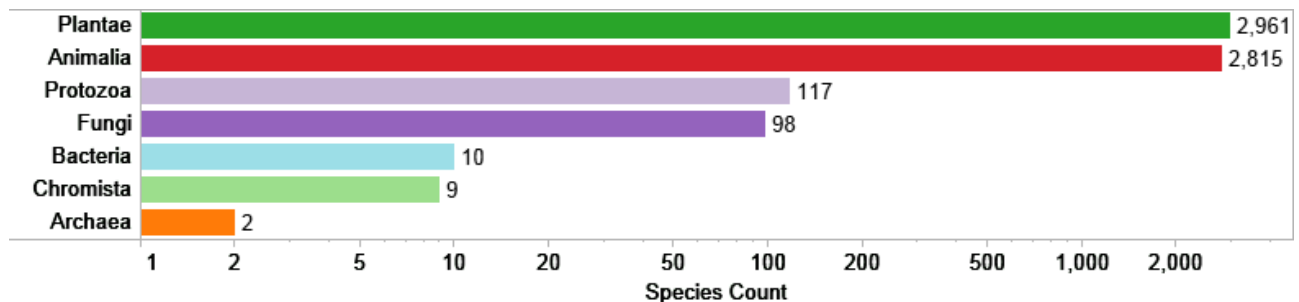


Table 1: Showing the number of species in Republic of Congo by kingdom using GBIF data.

Using global data it is possible to examine the wider distribution of Congolese species. Plate 2 shows where records exist across the globe for such species. Species that are found in two or more countries are referred to as 'cosmopolitan'. Each pie represents the number of species that are found in the Republic of Congo in a particular kingdom. It can be seen that a substantial number of species have a very wide regional distribution throughout sub-Saharan Africa and particularly within the countries on the south coast of Western Africa and those of a similar latitude. A small number have global distributions, of note here are the coastal countries of Central America, although it should be noted that some of these records may originate from research institutions or collections and therefore do not represent native or naturalised distribution.

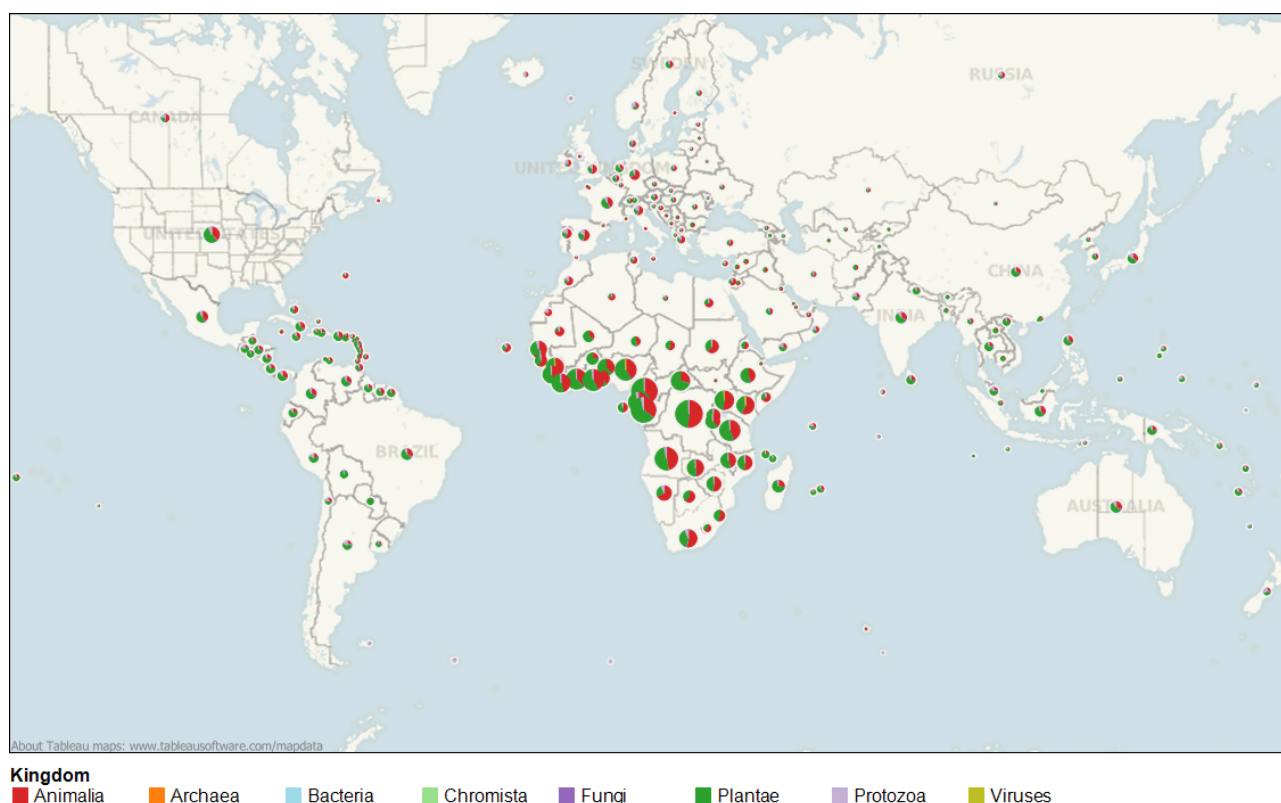


Plate 2: Global distribution of Republic of Congolese species shown by Kingdom and the number of species recorded in GBIF.

Biodiversity in Republic of Congo in the Patent System

As of 2013 a total of 119 patent documents in the main patent jurisdictions (European Patent Office, the United States, and the Patent Cooperation Treaty) specifically mention the Republic of Congo. This provides a general overview of references to the Republic of Congo in the patent system across all areas of invention. Only a proportion of these documents will also refer to species collected in, or sourced from the Republic of Congo. In addition, patent applicants will make reference to species that originate from the Republic of Congo but will not mention the Republic of Congo as the source of genetic resources or traditional knowledge.

Our aim in this section is to provide a brief overview of patent activity for genetic resources of relevance to the Republic of Congo. We focus on patent activity in the main patent jurisdictions in the period between 1976 and 2010. We then examine the results of research to identify genetic resources and traditional knowledge that originate from the Republic of Congo. In approaching patent activity for genetic resources from the Republic of Congo we focus on three categories of data.

1. Species that are known to be distributed in the Republic of Congo but are also distributed elsewhere in the world. This provides an overview of global patent activity for genetic resources of relevance to the Republic of Congo.

2. Species where a direct reference is made to the collection or origin of a species from the Republic of Congo. This data is based on a review of patents that make reference to a species known to be distributed in the country and the country name.
3. Species where available distribution data suggests that a sample is likely to have originated from the Republic of Congo. This data is known as Distribution data and refers to cases where GBIF presently only records a species as occurring in the Republic of Congo and no other country. Because taxonomic information is incomplete, this data provides a clue rather than proof that a species originated from the Republic of Congo.

We begin our analysis with an overview of biodiversity that is known to occur in the Republic of Congo in the patent system and then turn to data on species originating from the Republic of Congo.

The Republic of Congo shares a significant proportion of its known biodiversity with other countries in Africa and around the world. Plate 3 provides an overview of patent activity for species that are known to occur in the Republic of Congo and other countries around the world. This overview provides information on trends in applications and grants, the top species appearing in patents that are known to occur in the Republic of Congo, top applicants or assignees and technology areas.

In total we identified approximately 1,034 species names in patent data from the major jurisdictions that are known to occur in the Republic of Congo. When model organisms including crops such as *Zea mays* (maize) and *Homo sapiens* are excluded this falls to 1,027 species names and 761 accepted scientific names.³ This data is relevant for the Republic of Congo because it demonstrates that researchers and companies are conducting research and development on species that are known to occur in the Republic of Congo. As Plate 3 makes clear, research and development is taking place across a range of technology sectors and is targeted to a variety of markets.

³ The 761 figure excludes common model organisms such as *E. coli*, *Arabidopsis thaliana*, *Bacillus subtilis* and *Zea mays* (maize) that are globally distributed and are used as research tools in biotechnology. These species appear prominently in patent data for all almost countries and are therefore excluded.

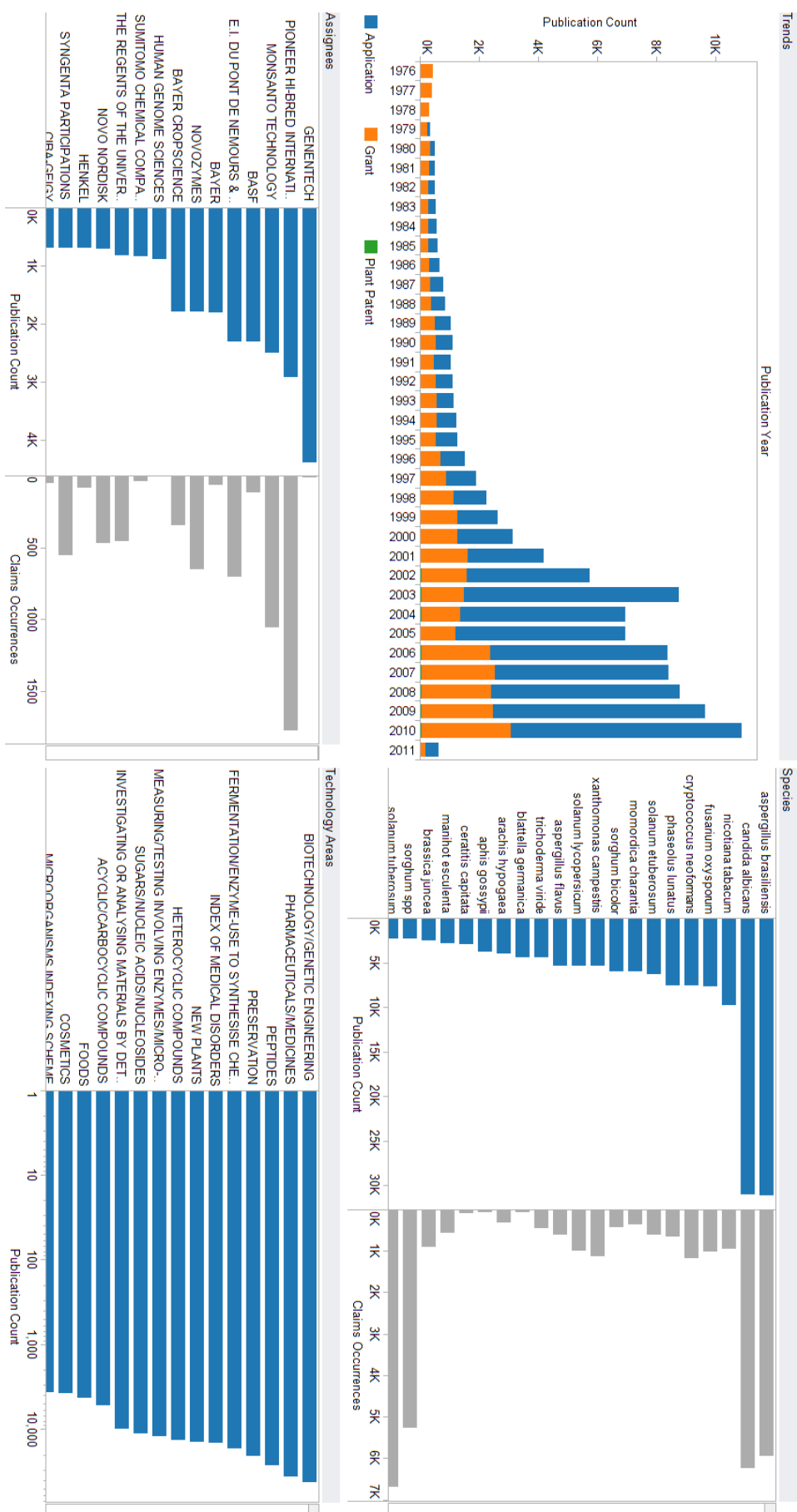


Plate 3: Overview of patent activity featuring species occurring in the Republic of Congo.

The top species of relevance to the Republic of Congo in global patent data include species used in biotechnology such as *Aspergillus brasiliensis* (formerly *Aspergillus niger*) and *Aspergillus flavus* which infects both crops and animals. *Candida albicans*, *Cryptococcus neoformans* and *Xanthomonas campestris* also feature as does the biofungicide *Trichoderma viride*. In total we identified 426 plant names in global data of relevance to the Republic of Congo with crops represented by species including beans (*Phaseolus lunatus*), peanut (*Arachis hypogaea*), tomato (*Solanum lycopersicum*), cassava (*Manihot esculenta*), mustard (*Brassica juncea*), cereals (*Sorghum spp*), and tobacco (*Nicotiana tabacum*). Other species include the plant pathogen *Fusarium oxysporum*, the bitter lemon (*Momordica charantia*) which is grown as a food crop and has pharmaceutical uses. Insects are represented by *Ceratitis capitata* (a fruit fly which causes major destruction to crops), the german cockroach (*Blattella germanica*) and the cotton aphid (*Aphis gossypii*).

The assignees in the overall data for species of relevance to the Republic of Congo range across a spectrum from biotechnology (e.g. Genentech and Novozymes), companies such as BASF and Bayer in areas such as biocides/insecticides, agriculture (e.g. Du Pont and Pioneer Hi-Bred International). More detailed analysis of technology areas revealed pharmaceutical companies such as Ciba Geigy and Novo Nordisk which specialises in treatments for diabetes. Also companies which develop new crops such as Syngenta and Monsanto feature prominently as does Sumitomo Chemical, which has interests in pharmaceuticals and crop science. Domestic and industrial chemical products are represented by Henkel. As this makes clear, there are a wide range of general and specialised technology areas and markets of relevance to biodiversity from the Republic of Congo. To gain a more focused view of activity we now turn to the results of research to identify organisms appearing in patents that were directly collected in the Republic of Congo or where distribution data suggests that the Republic of Congo is the likely source.

Species from The Republic of Congo in Patent Data:

In total we identified six species of organism that potentially originated from the Republic of Congo based on distribution data, and an additional two species were retained as being of relevance to the Republic of Congo. This is shown in Plate 4. In the next section a summary is provided for these species. This data will also be made available online to allow for further exploration of each case.

Plate 4 reveals that based on detailed analysis of patent documents, eight species appear in the data compared with the overview provided in Plate 3. The top species is *Fusibacter paucivorans*, a strictly anaerobic, halotolerant, spindle-shaped rod bacteria originally isolated in an African oil well. Research into microbial strains under denitrifying conditions for growth on crude oil which modify crude oil properties to enhance its recovery has been carried out by The University of California et al (WO2009029502A1) and Du Pont et al (WO2009029500A1, US2010044031A1 and US7740063B2). *Fusarium bulbigenum* is featured as expressing a choline oxidase enzyme which can be employed to obtain transgenic plants by Leif Buelow et al (WO1998026081A1) and as a source of enzymes in a process for immobilising biological material (Novo Industri WO1989000195A1 and EP0297912A2). *Methanobacterium congolense* is featured in the claim as a bacteria which can be used to convert carbon dioxide to methane during an industrial process (University of Chicago WO2008094282A1 and Laurens Mets US2009130734A1).

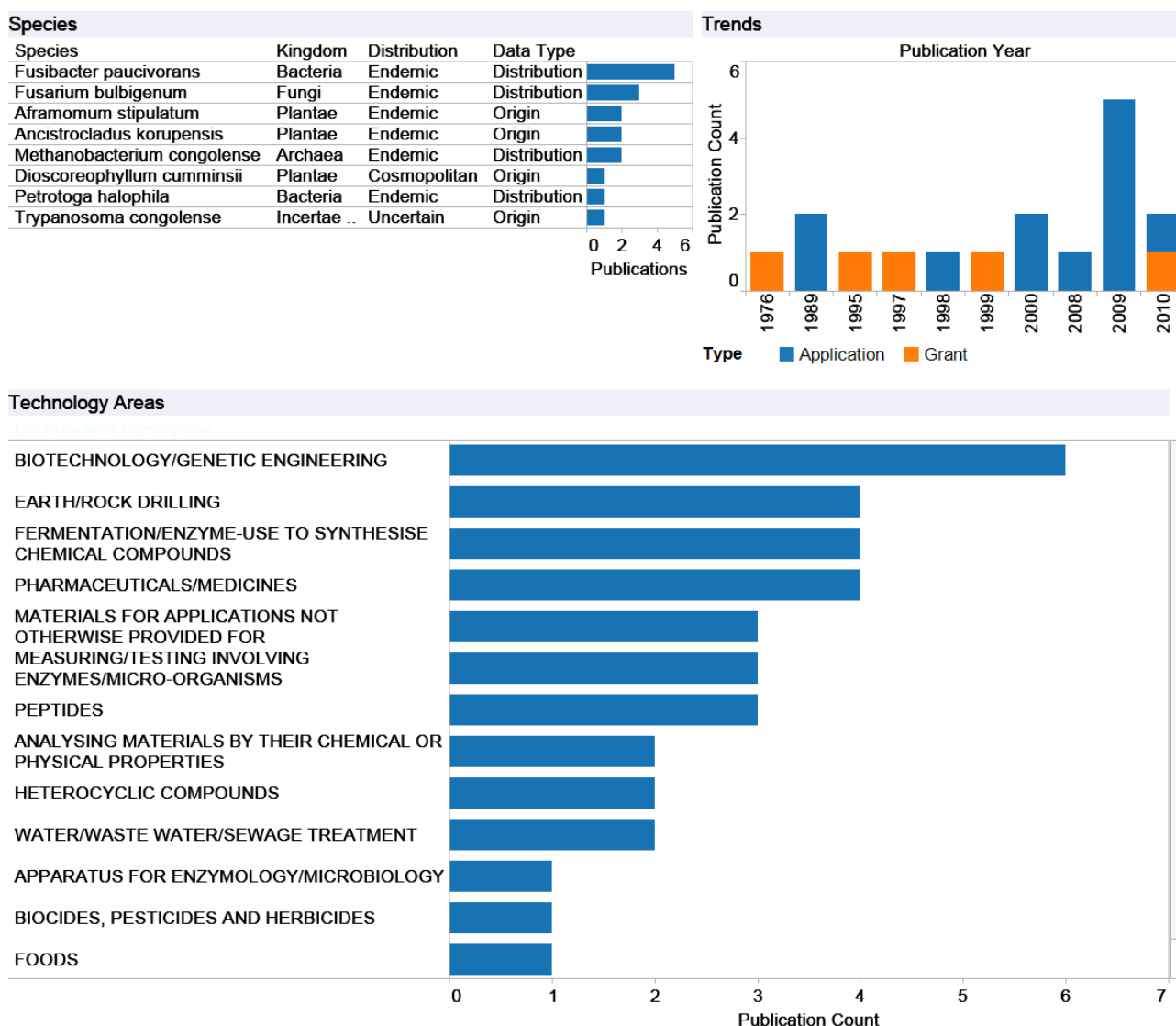


Plate 4: Species potentially sourced from the Republic of Congo.

In the realm of plants, *Aframomum stipulatum* seeds are used as the source for a pharmaceutical composition to treat erectile dysfunction (Peya Biotech Inc WO2000035466A1 and US5879682A). *Ancistrocladus korupensis*, a relatively recently discovered liana, provides an extract with powerful anti-viral properties (US Department of Health US5654432A and US5455251A). Finally, Monellin is extracted from the fruit of *Dioscoreophyllum cumminsii* for use as a sweetener by the University of Pennsylvania (US3998798A).

Other species of interest are *Petrotoga halophila*, featured in a long list of bacteria which can be used as a vehicle for expressing methyl halide transferase (MHT) for industrial production of organic compounds in a claim by the University of California (WO2009073560A1). This species is recorded in GBIF data as being found only in the Republic of Congo, and this case illustrates how species may be incorporated into a claim without having been specifically collected and used during the process of researching the invention.

The case of *Trypanosoma congolense* illustrates the need for international and regional cooperation concerning shared genetic resources. This cosmopolitan species has regional importance as the major pathogen responsible for the disease nagana in cattle across central and east Africa. Stichting Dienst Landbouwkundi and The International Livestock Research Institute claim means and methods for obtaining a factor from the species capable of at least in part inducing growth arrest and/or cell death of a trypanosome (EP1048728A1).

Full details of the species identified in the research are provided in the final section of this report. In considering this data we would note that while species endemic to the Republic of Congo merit close attention, cosmopolitan species such as *Dioscoreophyllum cumminsii*, that are native to several African countries, may hold significant potential for collaboration in economic development and conservation.

The Republic of Congo has a limited portfolio of species that appear in patents. It is important to emphasise that species may be involved in research and development in different areas of science and technology and may serve different markets. In some cases a species may be the target of a particular invention. In other cases a patent may suggest potential uses of a particular organism while in others, the species will be the direct focus of the claimed invention. We now turn to more detailed analysis of the technology areas involving species relevant to the Republic of Congo.

Technology Areas:

Table 2 provides a brief summary of the technology areas involved in patent activity for the Republic of Congo and is followed by a more detailed breakdown of activity.

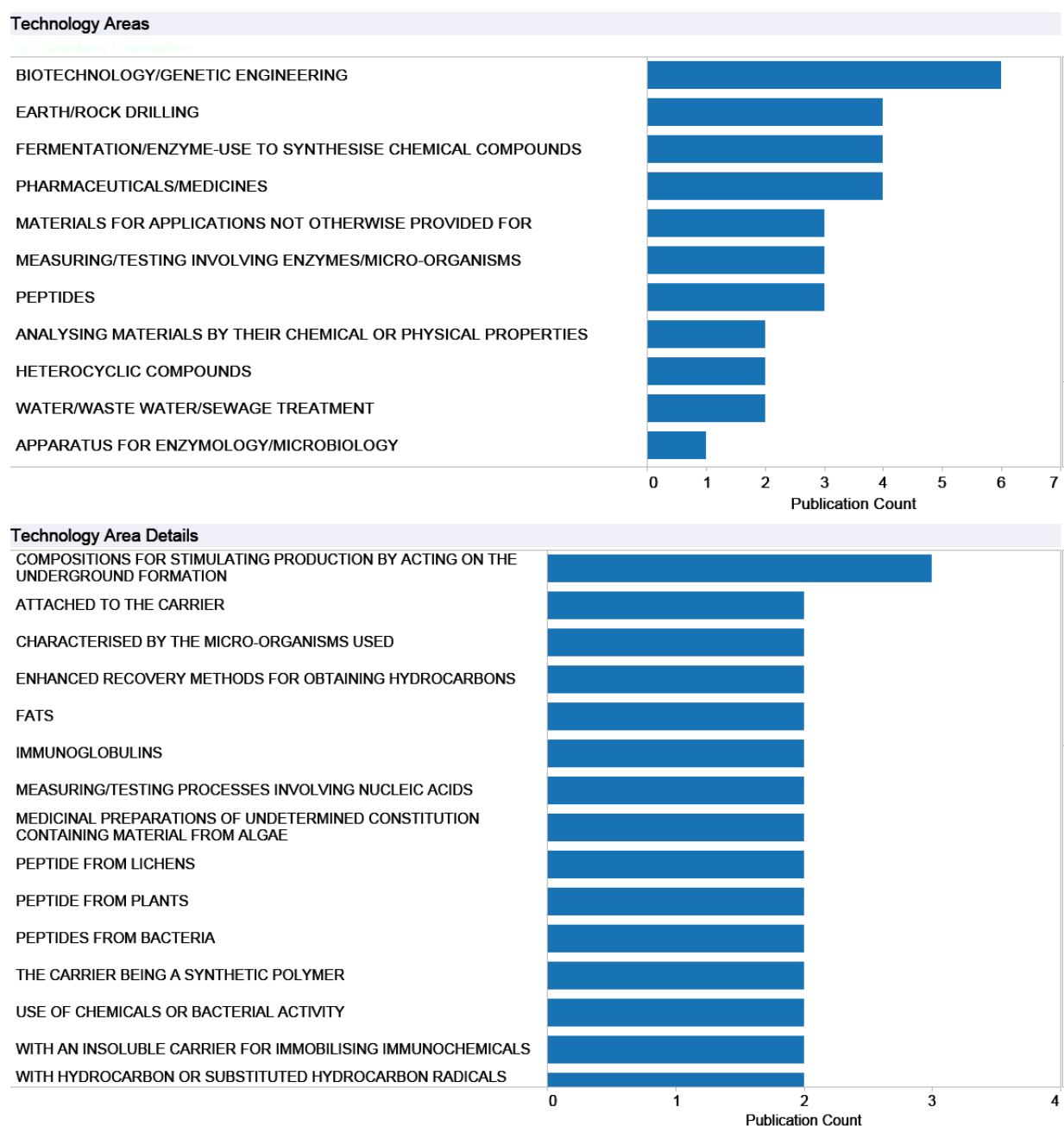


Table 2: Technology Areas

The general overview of technology areas provided in Plate 3 emphasises biotechnology, pharmaceuticals, enzyme use to synthesise chemical compounds and earthrock drilling. The narrower dataset that focuses on species from, or likely to originate from, the Republic of Congo repeats this pattern.

Table 3 usefully reveals the range of potential applications and technology areas where a species and its components may be deployed. As such a species may be a focus of

activity for a range of different products and markets. However, in the case of threatened species there will be a need for careful stewardship and conservation of target species.

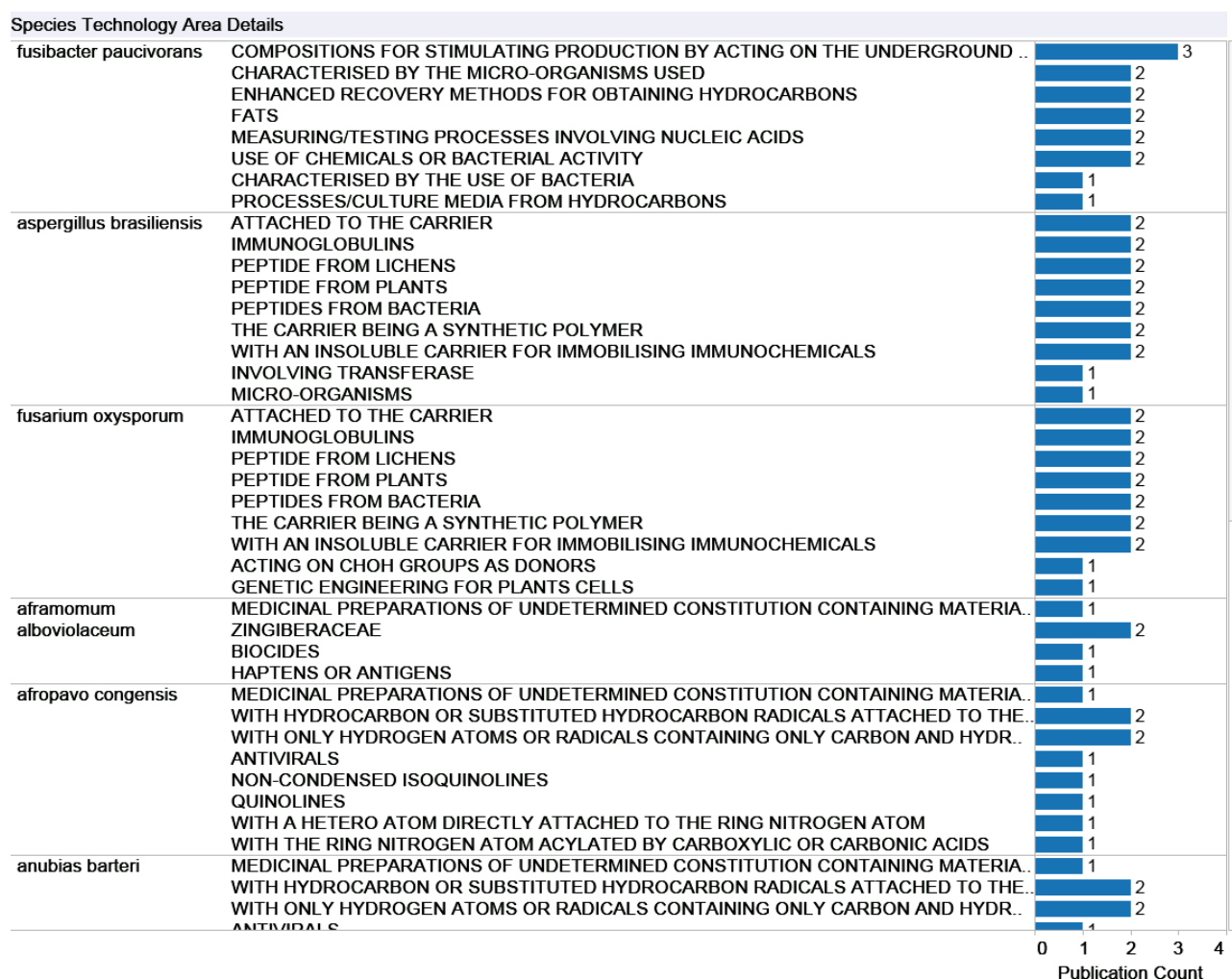


Table 3: Species and Technology Areas

Patent Claims:

Additional insights can be provided by examining the types of claims that are being made in relation to the species. A patent application may contain multiple claims but is required to contain only one invention. The first claim sets out the major focus of the claimed invention and frames all other claims.

Patents are awarded for three main classes of invention:

- Compositions of matter
- Methods or processes
- Machines

In some jurisdictions claims may be permitted for new plant varieties either under standard patent legislation or under specific legislation (e.g. US Plant Patents).

Table 4 displays a summary of the top terms appearing in patent claims relating to genetic resources for the Republic of Congo. As can be seen from this list, method, process and

composition all feature prominently, along with more specific terms relating to individual inventions, as would be expected with such a small statistical sample.

The first major category of patent claim is for compositions of matter (compositions). For example, *Aframomum stipulatum* is used in an invention which claims a “pharmaceutical composition for improving penile rigidity and/or preventing erectile dysfunction, including premature ejaculation, of a male mammal patient which comprises at least one of seeds from *Aframomum* species” (WO2000035466A1). Compositions are commonly extracts, compounds or combinations of ingredients (e.g. in pharmaceuticals or cosmetics and herbal medicines). Patent claims for compositions typically include a list of the compounds or ingredients that are the subject matter for protection. These claims are frequently broadly constructed such that the use of compounds from the species, the genus, and in some cases the family, are incorporated into the scope of the claims. While composition of matter claims may be constructed in various ways, broad claims may well impinge upon the ability of producers from a country to export products containing the claimed components into markets where a patent is in force.

The next category of patent claims is for methods, such as methods of producing a compound or treatment which leads to a desired outcome. Method claims are frequently more restrictive in their coverage of genetic resources because the genetic component is only claimed in so far that it is relevant to performing the method. That is, it is the method that is the focus of the invention. Therefore it is the method, and the use of the claimed genetic or biological component in performing that method, that is the subject matter of protection. An example of this is the potential use of *Methanobacterium congolense* to produce methane. In this case the species is used in a “method of converting carbon dioxide produced during an industrial process to methane comprising contacting a culture comprising methanogenic archaea”. (US2009130734A1). Clearly in this case the claim is for a method or process in which the species is utilised. Therefore it is the method, and the use of the claimed genetic or biological component in performing that method, that is the subject matter of protection.

Finally, one feature of patent activity involving species that originate from, or are distributed in, the Republic of Congo is the appearance of species names in long lists of species, genera or families of organisms rather than evidence of the direct collection of an organism or sample in the Republic of Congo. This is characteristic of many patent applications involving species from African countries but is unlikely to be particular to Africa. The purpose of these references can be described as incorporation of the referenced species, genus or family into the scope of the patent claims. That is, as in the case of *Petrogala halophila* mentioned above, any use of a specified compound or extract from the organism, genus or family is presented as falling within the scope of the claims or the use of any of a large number of organisms with similar properties. As we have suggested above, incorporation can provide useful clues on the potential properties and uses of organisms. The purpose of incorporation, from a patent lawyer’s perspective, is likely to be defensive. However, it is important to recognise the uncertainties and restrictions that essential incorporation of species, genera and families of organisms into patent claims may impose on producers from countries of origin in accessing markets.

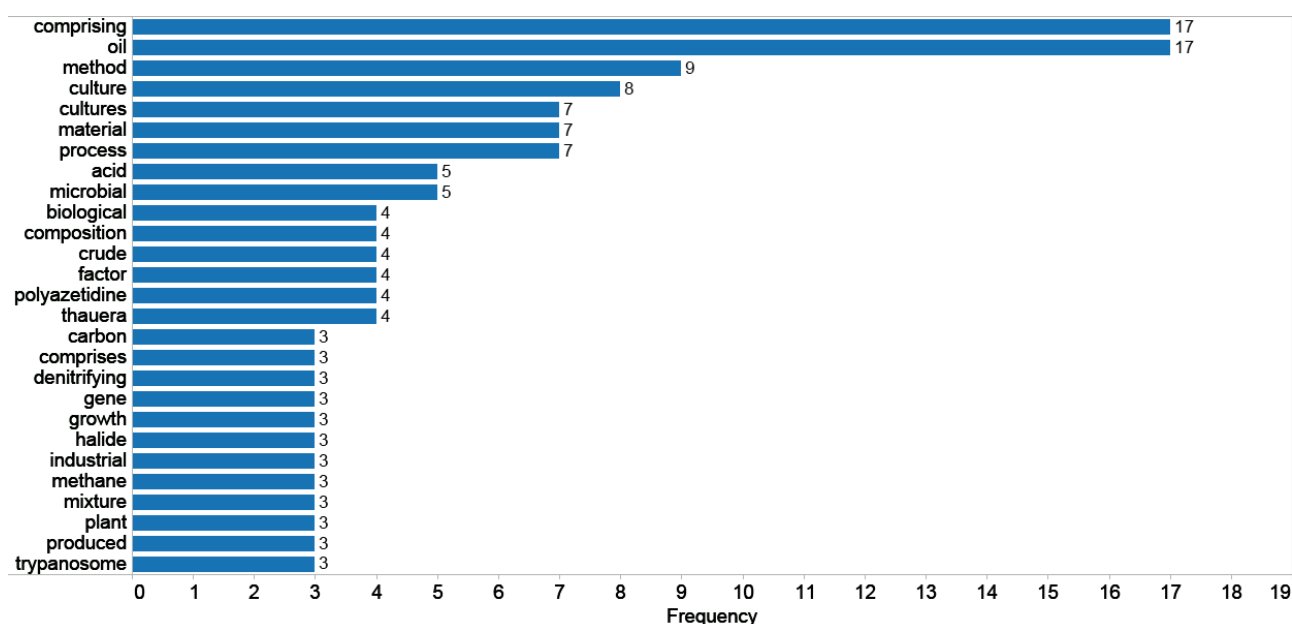


Table 4: Terms Appearing in the First Claims of Patent Documents

As this brief discussion of patent claims suggests, it is important to pay close attention to both the type and the content of patent claims. In addition, it is important to establish whether a patent has been granted, the jurisdictions where a patent has been granted, and whether it is in force. This type of analysis is particularly important when considering the potential development of products for markets. However, detailed patent analysis such as freedom to operate, patent validity, patentability, patent infringement and patent landscape analysis requires specialist analysis beyond the scope of the present report. Given the increasing importance of these issues for economic development, the World Intellectual Property Organization has established a Patent Landscaping initiative under its development agenda that commissions specialist patent research at the request of member states.⁴

Global Impacts and Global Markets:

We have seen above that a range of species are involved in patent activity of relevance to the Republic of Congo. However, it is important to note that many patent applications simply go nowhere. They may embody the hopes and ambitions of individuals, researchers, universities and companies but do not ultimately have an impact either in the patent system or in the market. A means for identifying important patents is therefore needed. Here we discuss two measures: a) patent citations, and; b) patent families.

Table 5 displays the citation scores by species and assignee for species relevant to the Republic of Congo. When a patent is filed and published it becomes prior art. Later patent applications that make claims for the same invention will find that the scope of what they claim as new, involving an inventive step, and useful will be limited by these earlier claims. This is recorded in the patent system as a citation. The more often that a patent is cited by later patent applications is a measure of the importance and impact of that patent within the patent system. In some cases a single patent application may attract over a thousand citations (e.g. *Thermus aquaticus* in biotechnology). Patent citation counts are therefore an

⁴ http://www.wipo.int/patentscope/en/programs/patent_landscapes/

important measure of the importance of patent activity because these scores reveal the impact of patent activity on other applicants.

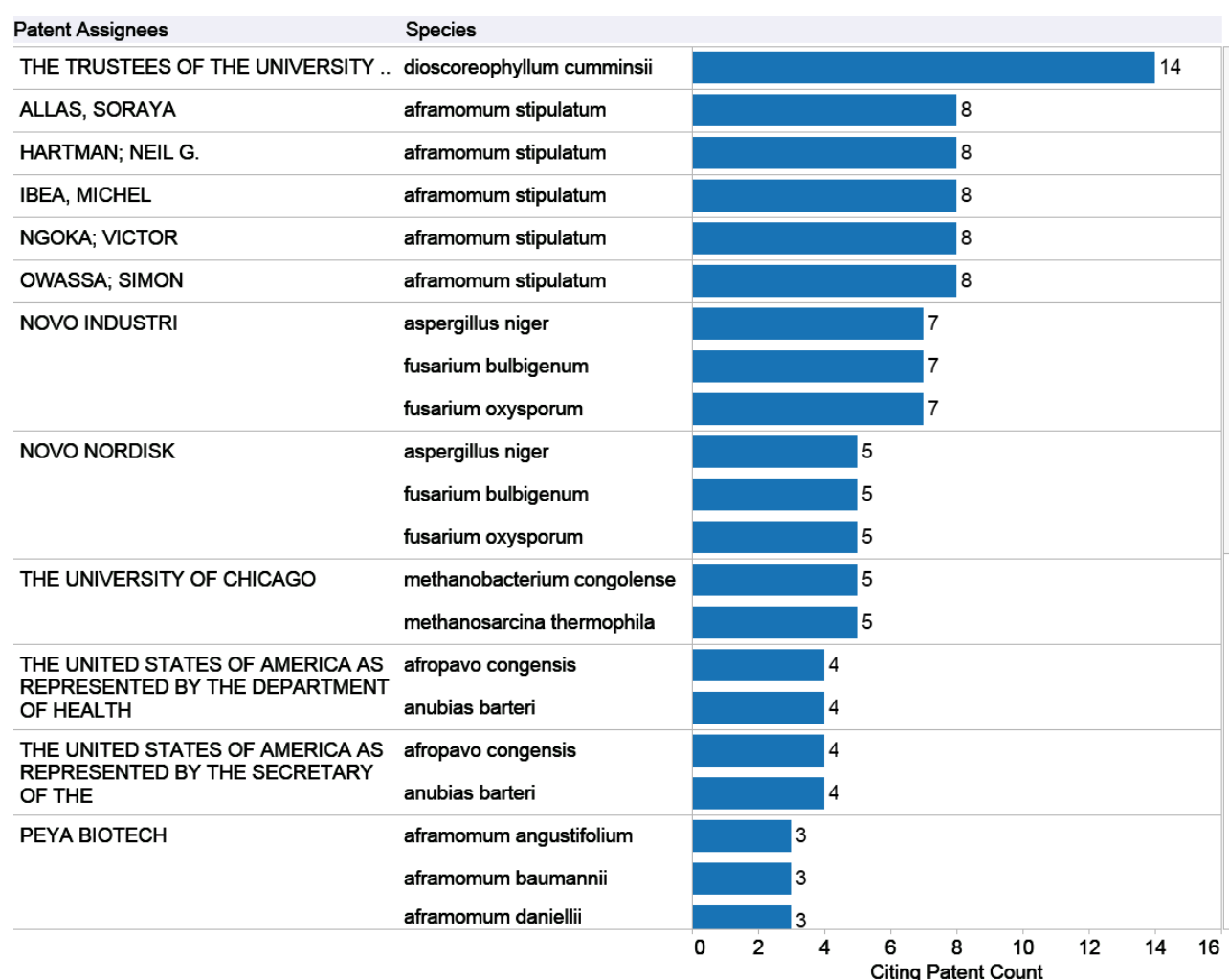


Table 5: Species and Assignee Citing Patents

In the case of the Republic of Congo Table 5 reveals a selection of citation scores for species of relevance to Republic of Congo organised by species and assignee.⁵ The top cited species receives fourteen citations in one document from The University of Pennsylvania involving *Dioscoreophyllum cumminsii* for “a sweet substance consisting essentially of the essentially pure, intensely sweet principle of the fruit *Dioscoreophyllum cumminsii* (Diels) extracted from the crude fresh fruit of *Dioscoreophyllum cumminsii*, substantially free from carbohydrate, which is a single homogeneous protein having intensely sweet taste” (US3998798A).

A second measure of the importance of patents is provided by the size of patent families. Table 6 shows the numbers of patent family members. A patent family is simply a set of patent documents that link back to an original parent filing (known as a “priority” filing). These patent documents can be filed anywhere in the world and can be tracked using

⁵ Table 5 aggregates the patent scores by species and assignee. If an assignee has four documents with citations involving the species, the numbers are aggregated to arrive at the total.

unique identifiers known as INPADOC numbers that link back to the parent document.⁶ In contrast with patent citations that provide an indicator of the impact of a patent on other applications in the patent system, the size of a patent family reveals how important a patent is to applicants. The reason for this is that they must pay fees each time they file a patent application that is linked to the parent (priority) application.

Patent family data of this type is useful in revealing the applicants who are most vigorously pursuing patent protection involving a species, or as is frequently the case, a group of species around the world. In the case of EP0297912A2 Novo Industri has claimed for an “immobilization method comprising mixing with polyazetidine, dewatering, sub-dividing and curing. The method is useful for enzymes, cell mass, coenzymes and antibodies...” and the resultant product is “physically strong, and less cross-linking agent can be used than in prior-art processes”. The family size is 33 which reveals significant importance to the company for this invention. It can be seen that a number of assignees have no family members beyond the original document. Where this is the case the assignee has not taken further protection. This may reveal that the invention was taken no further or that there was no economic reason to justify further protection.

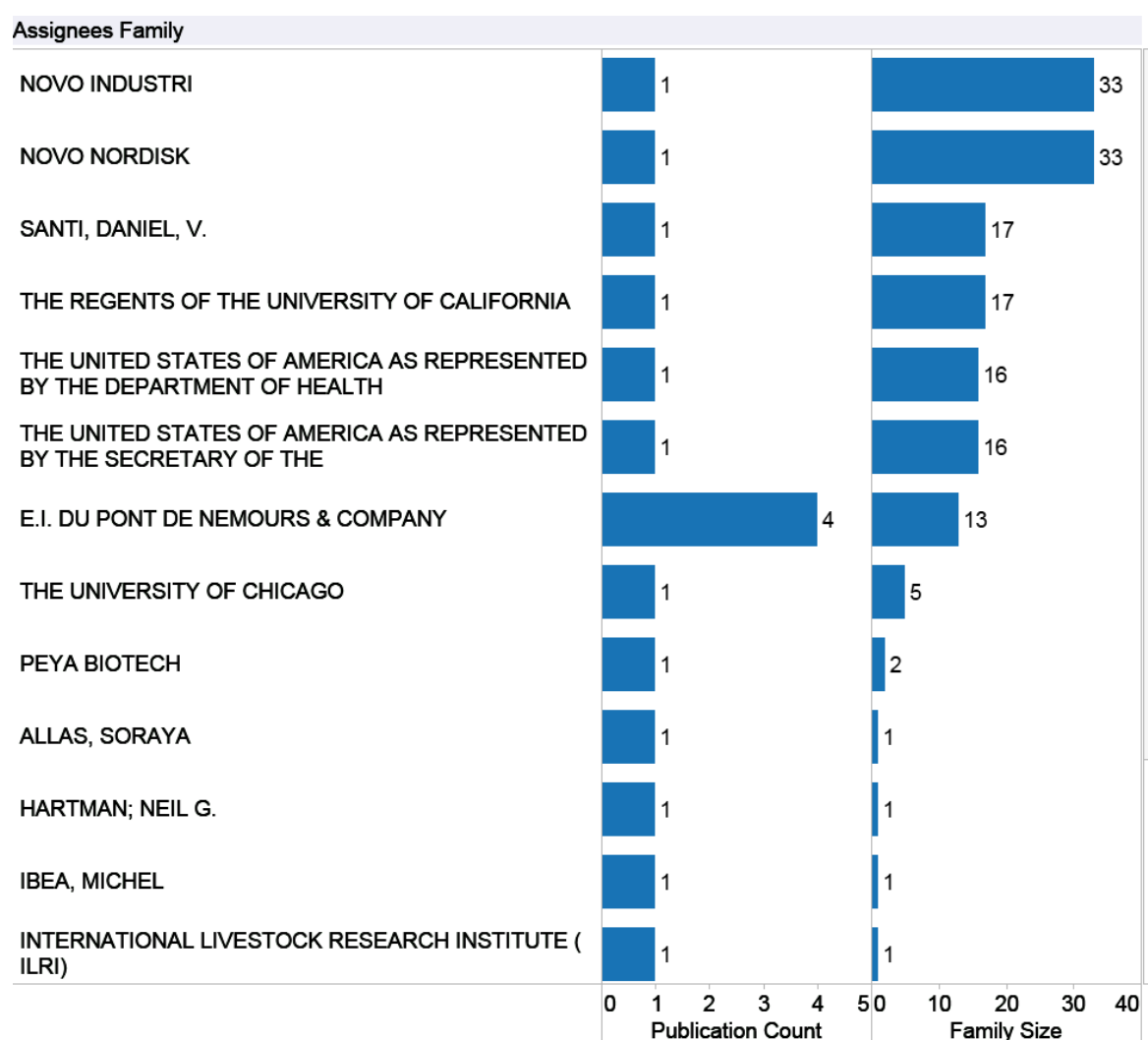


Table 6: Patent Assignees and Patent Families

⁶ INPADOC stands for the International Patent Documentation Centre which established the system. INPADOC is now part of the European Patent Office.

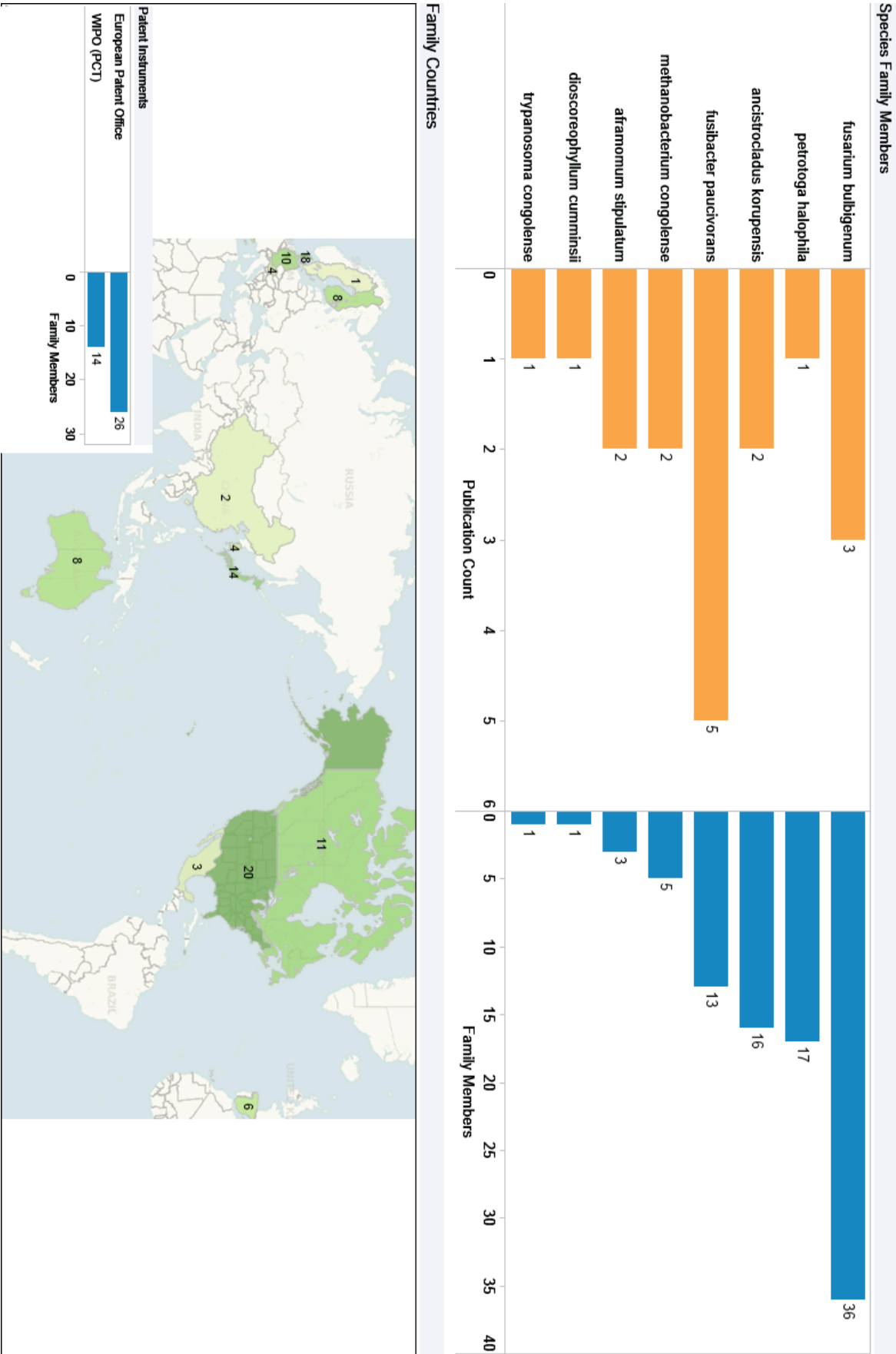
As this makes clear, while care is required in analysing why a particular species is referenced in a patent document, it is possible to trace the economic importance of particular patents to patent applicants using patent family data.

This type of analysis can be extended to the species level to consider the global impacts of patent activity and the position of patents involving a species in global markets.

Plate 5 displays patent family data by species and a global map of countries where family members linked to the species have been recorded. Please note that the map does not display the geographical locations for regional and international patent offices. Plate 5 is useful because it reveals what might be called the global reach or careers of species. We can immediately see the prominence of *Fusarium bulbigenum*, *Petrotoga halophila* and *Ancistrocladus korupensis* in this data.

Analysis of this type is also useful because it exposes the markets where protection is being sought as provided in the Family Countries map. As we might expect the United States is a primary market with Japan, Canada and European countries also featuring prominently. It is also striking that available data suggests that patent applicants are not pursuing protection in the Republic of Congo or other African countries. This suggests that opportunities may exist within internal markets in Africa where patent protection is unlikely to prove to be a barrier. At the same time, patent data also suggests countries where markets may exist for products involving biodiversity from the Republic of Congo.

Plate 5: Global distribution of family members



Concluding Remarks:

The research into biodiversity and patent activity featuring species originating from the Republic of Congo has been challenging because of the similarity of country names with its neighbour the Democratic Republic of Congo. Often the word 'Congo' is used to define either or both. Thus, clarifying the origin of a species within documents became problematic where it is a species shared by both countries. Furthermore, our research has revealed that a species of relevance to the Republic of Congo may appear in a patent document for a wide range of reasons where the species may not be the focus of the actual invention.

The Republic of Congo is a country with limited infrastructure and the majority of the population living in the south, where much of the biodiversity is recorded. The relatively low number of species recorded in data held by GBIF, considering the nature of the biomes in the country, which includes species-rich tropical rain forest, suggests that insufficient records are available to build a complete picture of the true diversity that exists. Indeed, many areas of the country have barely any georeferenced records available to GBIF. It is possible, as is illustrated by the recent discovery of the pharmaceutically useful genus *Ancistrocladus*, that there is considerable potential to uncover useful products by increasing the available knowledge of Congolese biodiversity. Therefore, the limited findings of this report should not be interpreted as signifying that biodiversity and traditional knowledge in the Republic of Congo are unimportant. Rather, it signifies that based on available evidence there is very little reason to be concerned about biopiracy and that experience in other African countries could usefully inform policy development in the Republic of Congo in developing capacity in access and benefit-sharing.

The purpose of this report has been to highlight the existing and potential role of species of relevance to the Republic of Congo for economic development in support of conservation. We would emphasise that our aim has not been to identify cases of biopiracy or misappropriation. In addition the aim of the research was not to identify the complete portfolio of patent activity for a particular species or genetic resource. We have focused on those patent documents that make direct reference to the Republic of Congo or where distribution data suggests that the Republic of Congo is a likely source.

The next section presents a summary card for each species identified in the course of the research. An online interactive version of these cards will be made available through abspat.net to facilitate further research.

Species Summary Tables

The following summary tables describe the species and patent activity involving the species. This data is based on known distribution of species and any reference to traditional knowledge and use of that species:

In reading these tables note that the number of documents refers to the number of documents retained during research on the origin of species of relevance to the Republic of Congo. It does not refer to the wider patent landscape for the species consisting of the total of number of documents making reference to the species, or its components, in the global patent system.

Species may appear in patent documents in this list for a variety of reasons:

1. Because they are a focus of the invention;
2. Because they are a target of the invention (i.e. pathogens);
3. Because they are incorporated into the claims of the invention;
4. Because a reference to a species, including in very limited cases a literature reference, indicates that the species is of potential interest for economic development and merits further investigation.

This report focuses on identifying species that are of potential interest for economic development and conservation based on their appearance in patent data. The data in this summary section should not be used to draw conclusions about misappropriation or biopiracy.

Republic of Congo distribution.

Species name: <i>Fusibacter paucivorans</i>	Kingdom: Bacteria	No Image Available
Brief description of species: A strictly anaerobic, halotolerant, spindle-shaped rod bacteria originally isolated in an African oil well.		
Distribution: Uncertain	No of documents: 5	
WO2009029502A1 WO2009029500A1 US2010044031A1 US2009082227A1 US7740063B2		
Detail: WO2009029502A1 US2010044031A1 US7740063B2: A novel phylogenetic identification method for identifying the indigenous anaerobic denitrifying bacterial species in an oil well that are capable of modifying crude oil's properties to enhance its recovery. WO2009029500A1 US2009082227A1 An application of pure culture microbial strains under denitrifying conditions for growth on crude oil thereby modifying crude oil properties to enhance its recovery.		


Republic of Congo distribution.

Species name: <i>Methanobacterium congolense</i>	Kingdom: Bacteria	No Image Available
Brief description of species: A non-motile, mesophilic, hydrogenotrophic, methanogenic bacterium, first isolated from an anaerobic digester used for the treatment of raw cassava-peel waste in Congo.		
Distribution: Uncertain	No of documents: 2	
WO2008094282A1 US2009130734A1		
Detail: A method of converting carbon dioxide produced during an industrial process to methane comprising contacting a culture comprising methanogenic archaea.		


Republic of Congo distribution.

Species name: <i>Fusarium bulbigenum</i>	Kingdom: Fungi	No Image Available
Brief description of species: Synonym for F. oxysporum which is one of the most common soil dwelling species.		
Distribution: Cosmopolitan	No of documents: 3	
WO1998026081A1 WO1989000195A1 EP0297912A2		
Detail: WO1989000195A1 EP0297912A2: Immobilization method comprising mixing with polyazetidine, dewatering, sub-dividing and curing. The method is useful for enzymes, cell mass, coenzymes and antibodies. Enzymes are derived from F. bulbigenum. WO1998026081A1: Genus listed as being useable in expressing enzyme on transgenic plants with increased freezing and choline tolerance.		


Of Congolese Origin

Species name: <i>Aframomum stipulatum</i>	Kingdom: Plantae	
Brief description of species: Synonym for Aframomum albobviolaceum. Aframomum is a genus in the ginger family, Zingiberaceae, found in west and central Africa.		
Distribution: Cosmopolitan	No of documents: 2	
WO2000035466A1 US5879682A		
Detail: A pharmaceutical composition for improving penile rigidity and/or preventing erectile dysfunction, including premature ejaculation, of a male mammal patient which comprises at least one of seeds from Aframomum species.		

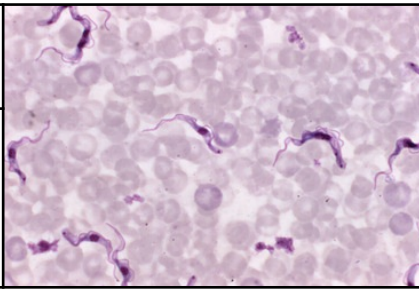
Of Congolese Origin

Species name: <i>Ancistrocladus korupensis</i>	Kingdom: Plantae	
Brief description of species: A tropical liana. These are climbing, twining plants, found in lowland to submontane, wet to seasonal evergreen or swamp forests.		
Distribution: Cosmopolitan	No of documents: 2	
US5654432A US5455251A		
Detail: Methods for isolating antiviral compounds from a plant species of the genus Ancistrocladus, antiviral compositions containing such antiviral compounds, and methods of using such antiviral compounds for treating patients with viral infections.		

Of Congolese Origin

Species name: <i>Dioscoreophyllum cumminsii</i>	Kingdom: Plantae	
Brief description of species: Dioscoreophyllum is a genus of three species of flowering plants in the family Menispermaceae, native to Africa. The species are lianas.		
Distribution: Cosmopolitan	No of documents: 1	
US3998798A		
Detail: Monellin extracted from the fruit of Dioscoreophyllum cumminsii.		

Of Relevance to the Republic of Congo

Species name: <i>Trypanosoma congolense</i>	Kingdom: Protozoa	
Brief description of species: Trypanosoma congolense is a species of trypanosomes and is the major pathogen responsible for the disease nagana in cattle.		
Distribution: Cosmopolitan	No of documents: 1	
EP1048728A1		
Detail: The invention provides means and methods for obtaining a factor capable of at least in part inducing growth arrest and/or cell death of a trypanosome.		

Of Relevance to the Republic of Congo

Species name: <i>Petrotoga halophila</i>	Kingdom: Fungi	No Image Available
Brief description of species: a thermophilic, moderately halophilic, fermentative bacterium isolated from an off shore oil well in Congo.		
Distribution: Endemic	No of documents: 1	
WO2009073560A1		
Detail: WO2009073560A1 A process for production of organic compounds using genetically engineered organisms expressing a S-adenosylmethionine (SAM)-dependent methyl halide transferase.		

Image Credits:

Aframomum stipulatum - Jawleyford [450px-Aframomum zambesiaceum foliage.JPG](#)

Ancistrocladus korupensis - Matthias Ziegler [16853756-ancistrocladus-korupensis-liane-with-special-medical-properties-outdoor-cameroon.jpg](#)

Dioscoreophyllum cumminsii - [Dioscoreophyllum cumminsii\(inunurin\).JPG](#)

Trypanosoma congolense - Dr Mae Melvin [10167_lores.jpg](#)

Appendix 1

Distribution map of GBIF records in the Republic of Congo coloured by taxonomic kingdom.

