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Background: New applications for patents on barley

Overview of patent applications filed for conventionally-bred barley up until the end of 2021

Introduction

The technical processes used in genetic engineering are different to those used in conventional breeding: genetic engineering allows the direct insertion of a trait into the genome of plants and animals. The use of genetic engineering techniques (such as transgenesis or so-called genome editing) induces genetic changes and genetic combinations (genotypes) which are unlikely to occur naturally. According to the wording of patent law, such technical processes can be a patentable invention.

The distinction between random genetic variations (as used in conventional breeding) and the targeted insertion of specific traits is crucial in the meaning of patent law, since this is the line drawn between patentable technical inventions and non-inventive methods. If this distinction is blurred, patents can cover all plants or animals and all genetic variations, regardless of how they were achieved.

The European Patent Office (EPO) has nevertheless started to grant patents on plants with genetic variations generated from non-technical and non-targeted processes. This is in complete disregard to biological principles and legal provisions. Patents have, for example, been granted on conventionally bred barley and all food and beverages derived thereof. This has caused major concerns among breeders[1], brewers[2], farmers and civil society organisations[3].

Other food plants in conventional breeding have also been patented, with the patents covering the plants, seeds, the harvest and food produced thereof. Such patents could threaten our future food security: access to resources needed in breeding, in agriculture and food production could be severely restricted by these patent monopolies. This is not only relevant to Europe, but also to the countries of the Global South.

The war in Ukraine has increased urgency of these problems: Ukraine is not only crucial in the supply of wheat and oilseed, it is, for example, also one of the biggest producers of barley in Europe. Seed monopolies which

1 Press release from *No patents on seeds!* (June 2021): https://www.no-patents-on-seeds.org/en/news/patent_on_barley_and_beer_upheld
2 Campaign of German "Free brewers": https://die-freien-gerstensorten.com/
3 Call for a ministerial conference to stop patents on seeds: https://www.no-patents-on-seeds.org/en/petition

can additionally hamper breeding and cultivation of food plants appear in this context to cause even more uncertainty.

Several granted patents as well as filed patent applications for beer and barley clearly show the effects on breeders, farmers, food producers and consumers. There are at least two stakeholders systematically claiming such patents: Carlsberg (Denmark) and CSIRO (Australia).

1. Carlsberg

Carlsberg has filed several patents on barley and beer over the last few years, partly in cooperation with other companies, such as Heineken. Carlsberg, based in Denmark, is one of the biggest brewers in the world, owning a broad range of brands. Currently, it is Carlsberg that has filed the most international patent applications for barley. The company is seeking to expand its market power to the plant breeding sector.

In order to 'invent' its new barley plants, Carlsberg uses relatively simple and well known methods: the grains of barley are brought into contact with a chemical substance. This enhances the rate of mutation and the number of genetic variations. Crossing and selection are subsequently used to breed plants with the desired characteristics.

Carlsberg has already filed around a dozen such patent applications. These include, for example, randomly induced mutations that influence the process of brewing and the flavour of the beer after storage. Together with around 40 other organisations, *No Patents on Seeds!* has filed oppositions against three of these patents.

The EPO announced in 2022 that they would be granting a further patent (EP1727905). The patent about to be granted to Carlsberg is based on random genetic variations found in barley, which prevent the production of a naturally occurring enzyme. The aim is to improve the taste and shelf-life of beer. According to the patent, the same trait can also be introduced via genetic engineering. The patent itself claims as an 'invention' all the barley plants with desired characteristics, regardless of how they were achieved. The use of the barley for brewing beer is claimed as proprietary technology.

Carlsberg appears to be aware of the problem that their barley is actually not patentable. This is probably the reason why - in the patent EP1727905 as well as in more recent patent applications – it is repeatedly stated that techniques such as CRISPR/Cas, could be used additionally, but are not actually necessary. The most recent patent application filed in 2021 (WO2021175786) is a typical example of the way in which Carlsberg is trying to create the impression of an 'invention': the plants as claimed show random genetic variations (see examples on pages 58ff). At the same time, the patent states that applying CRISPR/Cas remains a possibility (see page 44). This genetic engineering method is, however, not really applied in the patent and is not actually necessary to achieve the desired traits. Nonetheless, the claims (pages 70ff) in the patent cover all barley plants with described genetic variations as the invention of Carlsberg, regardless of how they were achieved.

The use of the barley for brewing beer is claimed in patent WO2021175786 as part of the invention. Several types of beer are named on page 41, such as Altbier, Berliner Weisse, Blonde Ale, Dortmunder Export, Doppelbock, Hefeweizen, Helles, Kölsch, Pale ale, Pilsener, steam beer, stout, lager as well as whiskey and vodka. Producing these beverages would be subject to the patent if the patented barley is used.

Table (1) Overview: Patents on barley filed by Carlsberg

international application (WIPO)[4]	EP number (EPO)	Content	Legal status
WO02053721	EP1346030	Taste of the beer; claims covering barley and beer (including transgenic plants)	Lapsed
WO2005087934	EP1727905	Taste of the beer; claims covering barley and beer	grant intended
	EP2290089	Taste of the beer; claims covering barley and beer	Examination
	EP2305797	Taste of the beer; claims covering barley and beer	Withdrawn 2017
WO2010063288	EP2373154	Taste of the beer; claims covering barley and beer	Granted 2016 Opposition and appeal filed, maintained
WO2010075860	EP2384110	Taste of the beer; claims covering barley and beer	Granted 2016 Opposition and appeal filed, revoked 2021
WO2011150933	EP2575433	Taste of the beer; claims covering barley and beer	Granted 2016 Opposition filed Oral hearing 10.05.2022
WO2018001884	EP 3478832	Methods for selection of barley plants (but no plants claimed as invention)	Granted 2022
WO2019129736	EP3731627	Changed quality of barley for brewing process; claims covering barley and brewing methods	Request for examination
WO2019129739	EP3731628	Changed quality of barley for brewing process; claims covering barley and brewing methods	Request for examination
WO2019134962		Changed quality of barley for brewing process; claims covering barley and brewing methods	Withdrawn
WO2021038003	EP3785529	Taste of the beer; claims covering barley plants and beer production method	Deemed to be withdrawn (09.02.2022)
WO2021069614		Methods for mutagenesis and further breeding of barley	Not yet under examination
WO2021175786		Changed quality of barley for brewing process; claims covering barley and brewing methods	Not yet under examination

4 World Intellectual Property Organisation (WIPO); many of these patents also are examined by the EPO.

2. CSIRO

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has also registered several patents at the World Intellectual Property Organisation (WIPO) on barley derived from conventional breeding. CSIRO is owned by the Australian state, and pro-actively promotes license contracts with companies to increase profits from their patents. CSIRO's activities are seen as very controversial, with the organisation at one point being called 'Australia's biggest patent troll'. The backdrop to this were CSIRO's attempts to claim license fees from US companies involved in developing WIFI technology.[5]

CSIRO also has a controversial history of being involved in patents on life: it received a European patent on salmon and trout (EP1965658), whereby the 'invention' simply consisted of feeding the fish with particular plants. Other European patents granted to CSIRO claim wheat derived from random mutagenesis and food produced thereof (EP1649022). *No Patents on Seeds!* successfully filed an opposition against this patent.[6]

CSIRO has also filed several patent applications for barley with random mutations, including drinks and food made using the barley. It appears to have turned some of its attention to barley which produces less gluten. Starting with traditional varieties, CSIRO engaged in further breeding using genetic variations (random mutations). The aim was to generate a barley with a lower concentration of specific proteins that contribute to the concentration of gluten in food and drinks and are involved in intestinal disorders, such as coeliac disease. Other patent applications are for barley with changes in starch composition, which are also supposed to provide health benefits for consumers.

Table (2) Overview: Patents on barley filed by CSIRO

international application (WIPO)	EP number	Content	Legal status
WO2009021285	EP2190970	Reduction in gluten; claims cover barley, food and beer	Examination
WO2011011833	EP2458974	Changes in starch composition; claims cover barley, food and beer	Examination
WO2014197943	EP3008161	Reduction in gluten; claims covering barley, food and beer	Examination
WO2021155435		Reduction in gluten; claims cover barley, food and beer	Not yet under examination

The most recent patent application, WO2021155435, is a typical example of the way in which CSIRO is trying to build its patent monopolies: the plants are produced by using traditional barley varieties which show random genetic changes (see examples, pages 53 ff, especially page 86). At the same time, the patent descriptions include several techniques for genetic engineering, such as transgenesis (page 43) or CRISPR/Cas gene scissors applications (page 39), to create the impression of a technical invention. However, none of these techniques were applied in developing the plants and are not necessary to achieve the desired traits.

The CSIRO patent applications follow a very similar pattern of blurring the differences between random mutations and genetic engineering. Again, patent applications filed by CSIRO claim a monopoly on all barley plants with the genetic variations as described, regardless of how they are generated (see claims, pages 95 ff).

5 https://arstechnica.com/tech-policy/2012/04/how-the-aussie-government-invented-wifi-and-sued-its-way-to-430-million/
6 The patent on salmon: https://www.no-patents-on-seeds.org/en/patent-cases/salmon

Methods for brewing the beer, producing food and the food products made from the barley are all covered by the patent claims. Claim 41 explicitly mentions “beer or whiskey” as part of the ‘invention’. Claim 44 lists “grain, soup, stew, gruel, leavened or unleavened bread, pasta, noodles, breakfast cereal, snack food, cake, pastry or a food containing a flour-based sauce.”

As mentioned above, according to patent applications (such as WO2009021285 and WO2014197943), the aim is to produce food and drinks from barley which can also be consumed by people who are sensitive to proteins (gluten). It appears that so far only a few companies have had access to this barley that is cultivated in Australia: in 2016, Radeberger, the biggest German beer company, signed a license contract with CSIRO and started to import the barley to Europe.[7] However, Radeberger stopped importing the barley in 2019. The reason given was that the market segment was too small.[8]

Nevertheless, if other beer brewing companies, food producers, breeders or farmers want to use the barley, they face serious hurdles: they cannot freely cultivate the barley, neither can they use it for breeding, brewing or baking bread, as would be the case if no patents had been registered. In contrast to regulations under the plant variety protection system, the seeds are not freely available to produce barley varieties that could also be grown in Europe. Without a license from CSIRO, plants as well as food and beverages cannot be made available, even if consumers might be interested.

Luckily, in this case, there is an alternative source of gluten-reduced (or even ‘-free’) beverages: several brewers are using the usual barley plants, but are able to reduce the gluten content by a specific process of brewing.

3. Demands

We are calling for a conference of ministers from the contracting states of the EPO to be held within one year in order to take swift action on implementing effective measures, and thus stop patents on conventional plant and animal breeding. All possible measures must be taken on both a national and a European level to stop patents on conventionally-bred plants and animals.

This must include prohibiting patents on the processes of crossing, selection and random mutations, as well as taking measures to prevent the extension of the scope of patents granted on genetic engineering techniques to cover plants and animals derived from conventional breeding.

The scope of patents on plant and animal breeding needs to be restricted to the specific technical processes of genetic engineering in order to make existing prohibitions effective.

In general, plants and animals, including their genes and genetic variations, should not be regarded as patentable products!

7 https://www.abc.net.au/news/rural/2017-02-14/gluten-free-barley-to-german-beer/8269436

8 https://www.sueddeutsche.de/wirtschaft/getraenke-brauer-setzen-auf-glutenfreies-bier-dpa.urn-newsml-dpa-com-20090101-200302-99-154429 (in German)