



Patents on genes and genetic variations can block access to biological diversity for plant breeding

Patent research conducted in 2021 shows how industry is trying to patent genes, plants, seeds and food

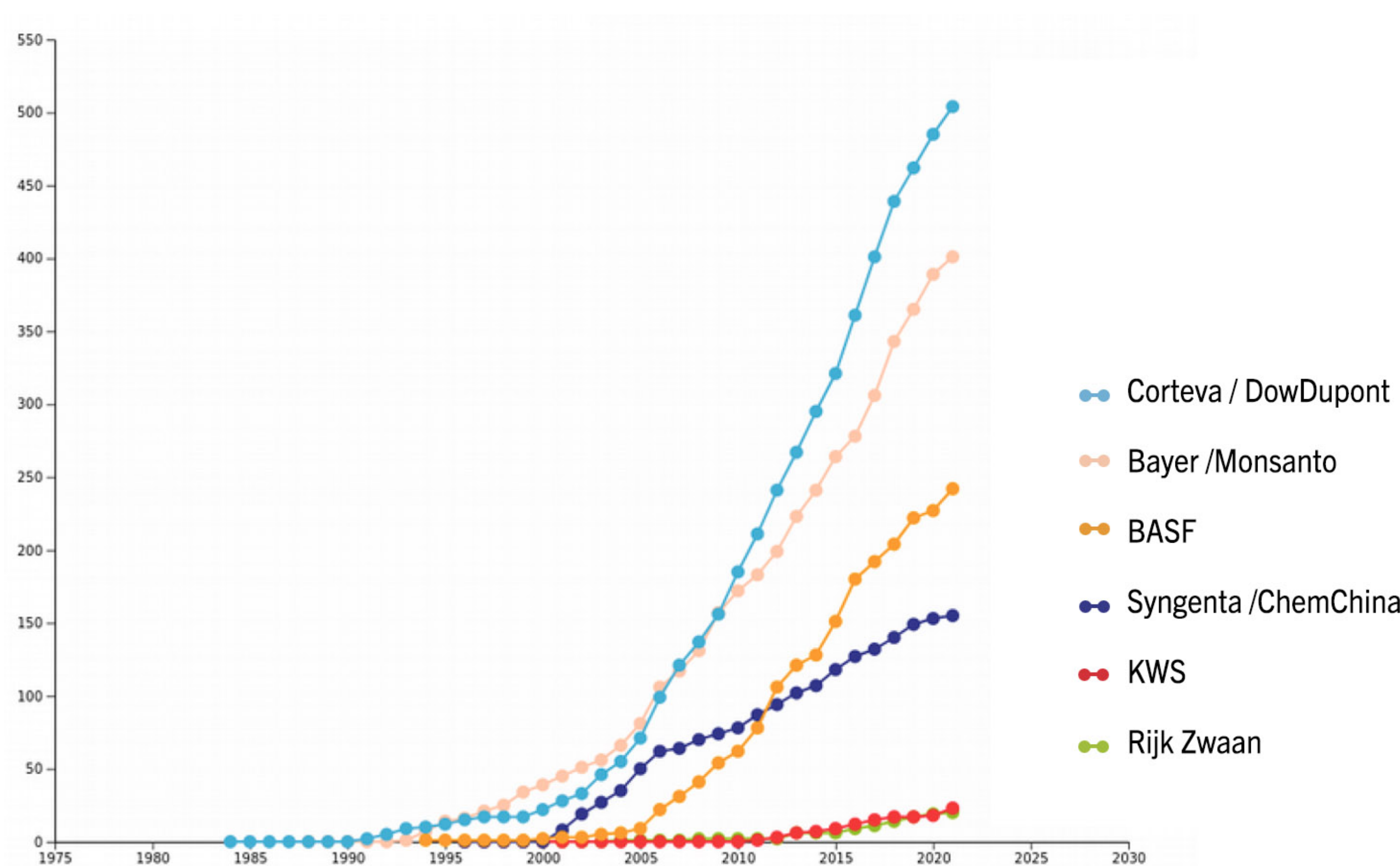


Figure 3: Patents granted on plants by the EPO, categorised by companies, per year, accumulated since 1990. Research according to official classifications (IPC A01H or C12N15/82). Source: www.kein-patent-auf-leben.de/patentdatenbank

Patent applications

Syngenta, WO2021154632 claims
around 5.000 single nucleotide
polymorphism (SNPs) detected in
wild relatives of soybeans

Table 1: SNP Positions within SEQ ID NO: 1 that are associated with increased resistance to ASR

Table 1 is organized as follows: (Position in Scaffold 22052, favorable allele, unfavorable allele)

(24,A,G)(2425,G,A)(3023,T,C)(3024,C,T)(3094,A,C)(3158,A,G)(3666,G,A)(4104,C,A)(4133,
T,TTGCTGCTATAATCGATTAAGC)(4155,G,C)(4156,C,A)(4157,T,C)(4159,C,G)(4160,T,
G)(4239,C,A)(4289,A,G)(4321,C,T)(4355,C,T)(4474,G,T)(4528,C,T)(4659,A,C)(4820,T,C)(4
906,T,G)(5028,T,G)(5077,T,C)(5202,A,C)(5228,G,A)(5254,G,A)(5291,T,C)(5316,G,A)(5613,
G,A)(5649,T,C)(5744,C,T)(5755,T,TGGGTCATGGC)(5758,GACAACA,G)(6029,A,C)(6133
,C,T)(6183,T,A)(6210,A,ACT)(6599,T,C)(6695,G,A)(6931,T,TG)(6937,C,T)(7007,T,C)(7030
,A,G)(7094,A,G)(7117,T,TA)(7322,T,C)(7467,A,G)(7530,G,C)(7558,G,A)(8071,A,G)(8367,
A,G)(8524,T,C)(8691,T,G)(8729,A,C)(8877,G,A)(8913,G,T)(9001,A,ATG)(9005,A,G)(9007,
G,A)(9008,G,C)(9010,A,T)(9199,T,A)(9311,C,T)(9447,T,C)(9568,A,G)(9595,T,C)(9648,T,A)
(9871,A,AC)(9896,T,A)(9911,C,T)(10105,C,T)(10319,C,T)(10443,A,G)(10487,A,C)(10497,
A,G)(10567,T,C)(10738,A,C)(10914,G,T)(10945,T,A)(11114,A,C)(11134,C,A)(11155,G,T)(1
1219,A,G)(11272,C,T)(11869,A,G)(11975,AT,A)(12370,C,T)(12403,C,T)(12474,C,T)(12567,
G,C)(12734,G,A)(12997,C,A)(13052,A,G)(13071,G,A)(13101,C,T)(13103,A,G)(13174,C,A)(
13210,C,G)(13257,C,G)(13430,A,G)(13474,T,C)(13589,G,C)(13823,A,C)(13943,TA,T)(1409
3,A,G)(14246,C,T)(14277,G,A)(14303,A,C)(14337,G,A)(14877,T,G)(14907,T,C)(14926,A,G)
(15061,C,T)(15405,A,G)(15525,A,C)(15722,T,C)(15783,C,A)(15809,A,T)(15907,ATGCATA
GT,A)(15991,G,A)(16377,A,T)(16418,A,G)(16437,A,G)(16590,G,A)(16695,T,C)(16725,A,C
) (16729,A,T)(16951,C,T)(17006,T,C)(17302,G,A)(17588,G,A)(17679,G,A)(18002,A,G)(1862
0,G,T)(18631,A,G)(18673,C,T)(19024,G,T)(19060,G,A)(19260,G,A)(19349,G,A)(19535,C,A
) (19559,T,C)(19693,T,C)(19773,A,C)(19830,A,G)(20155,A,G)(20235,T,G)(20382,C,T)(2046

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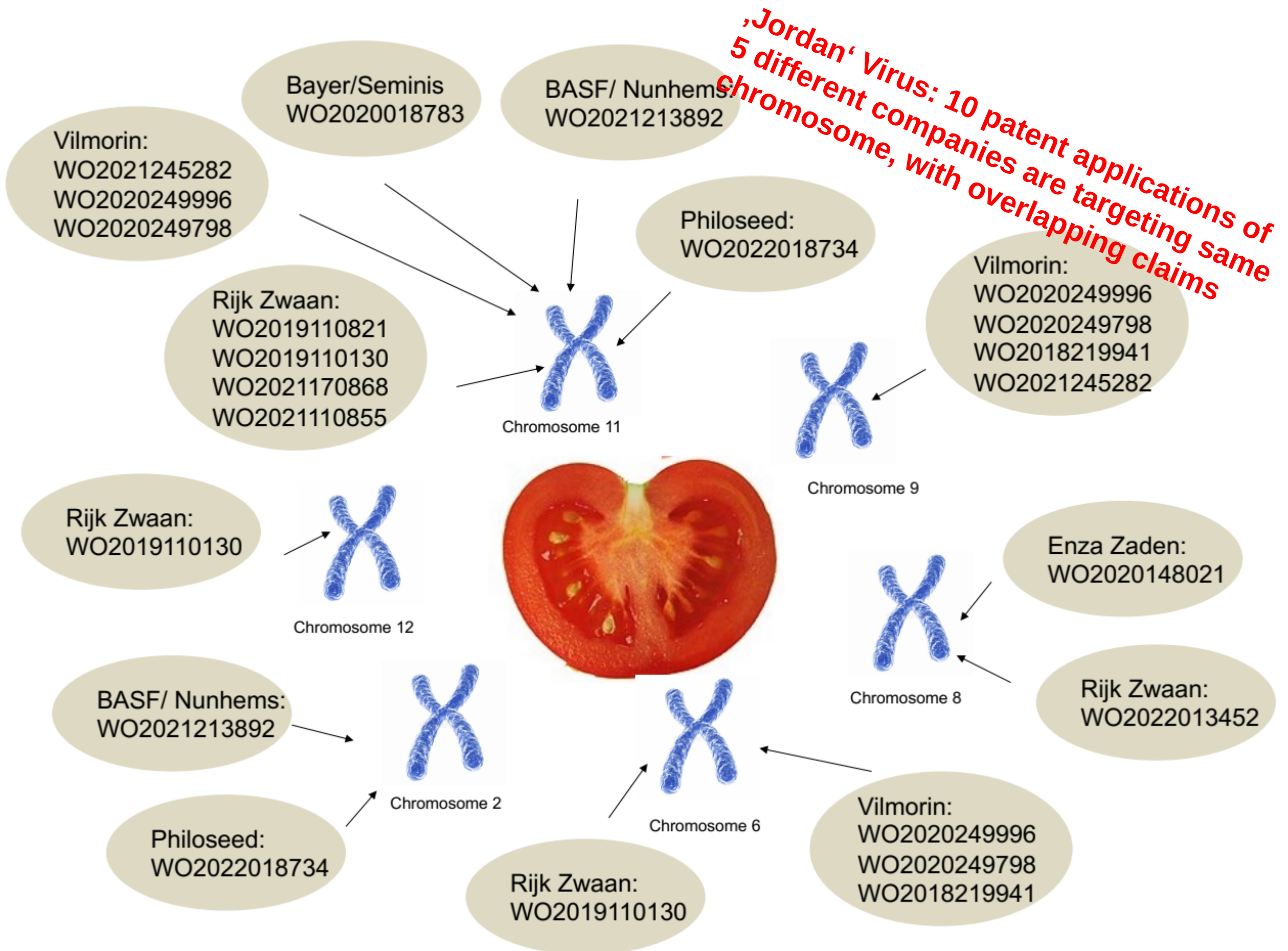
WO 2021/154632

PCT/US2021/014861

THAT WHICH IS CLAIMED IS:

1. An elite *Glycine max* plant having in its genome a chromosomal interval chosen from SEQ ID NOs: 1, 2, 3 or a portion of any thereof, wherein said chromosomal interval confers increased Asian soy rust (ASR) resistance as compared to a control plant not comprising said chromosomal interval.
2. The plant of claim 1, wherein the chromosomal interval is chosen from SEQ ID NO: 1 or a portion thereof.
3. The plant of claim 1 or 2, wherein the chromosomal interval comprises a SNP marker associated with increased ASR resistance wherein said SNP marker corresponds with any one of the favorable SNP markers as listed in Tables 1-3.
4. The plant of claims 1-3, wherein the chromosomal interval is derived from *Glycine tomentella* chromosome 20.

International patent applications on resistance against TBRF-Virus in tomato



Granted patents

The Carlsberg patents (random mutations): EP2373154 & EP2575433

Patents on barley and beer

basic research
and random mutagenesis
of kernels

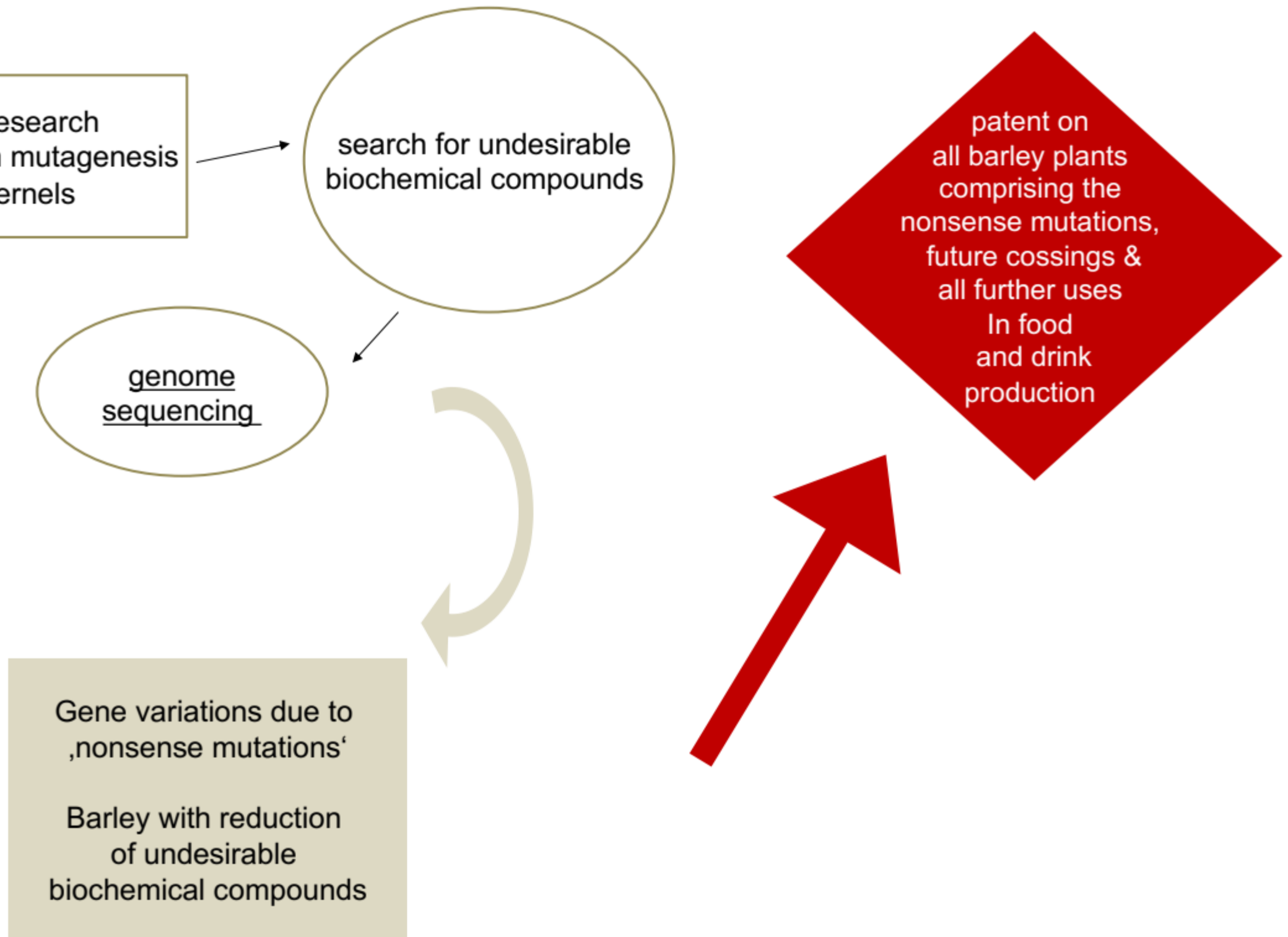
search for undesirable
biochemical compounds

genome
sequencing

Gene variations due to
'nonsense mutations'

Barley with reduction
of undesirable
biochemical compounds

patent on
all barley plants
comprising the
nonsense mutations,
future crossings &
all further uses
In food
and drink
production



Patents on lettuce, grant intended: EP2961263

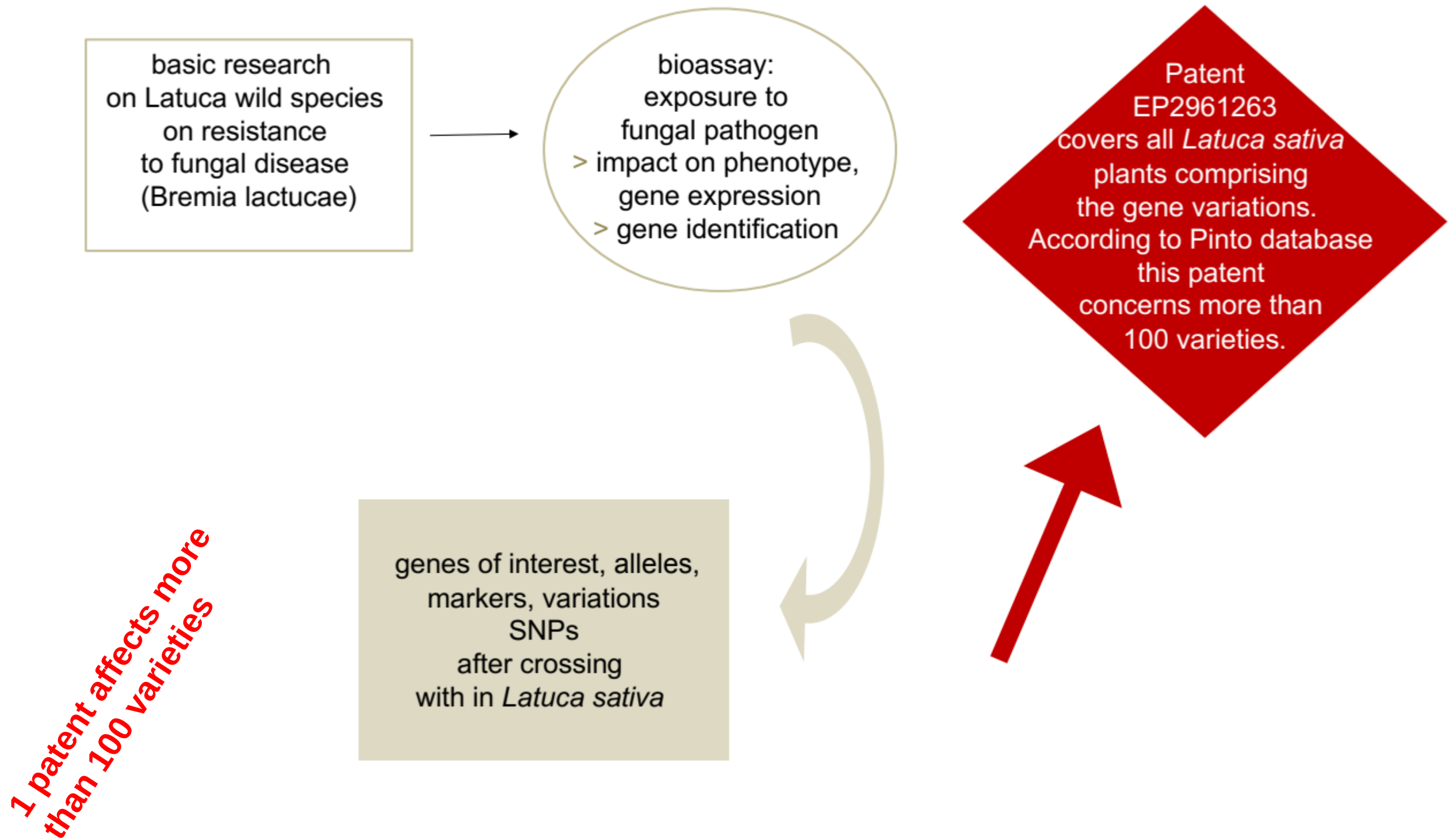


Table 1: Overview of 10 examples of European patents already granted on European plant varieties derived from conventional breeding (Source: www.euroseeds.eu/pinto-patent-information-and-transparency-on-line/)

Patent	Content	Company	Number of varieties concerned
EP2961263	Lactuca sativa with Bremia lactucae (downy mildew) resistance	Bejo Zaden	121
EP2515630	Genetic Markers Associated with Drought Tolerance in Maize	Syngenta	93
EP2451269	Plant resistant to a pathogen	Syngenta	56
EP1804571	PMMOV resistant Capsicum plants	Monsanto Invest	47
EP2464215	Methods for enhancing the production and consumer traits in plants	Syngenta	46
EP2464213	Methods for enhancing the production and consumer traits in plants	Syngenta	45
EP0921720	Aphid resistance in composites	Rijk Zwaan	38
EP1973396	Screening method for selecting plants that show a reduced wound-induced surface discolouration and plant and plant parts thus obtained	Rijk Zwaan	38
EP2586294	Peronospora resistance in Spinacia oleracea	Rijk Zwaan	38
EP1525317	Clubroot Resistant Brassica Oleracea Plants	Syngenta	36

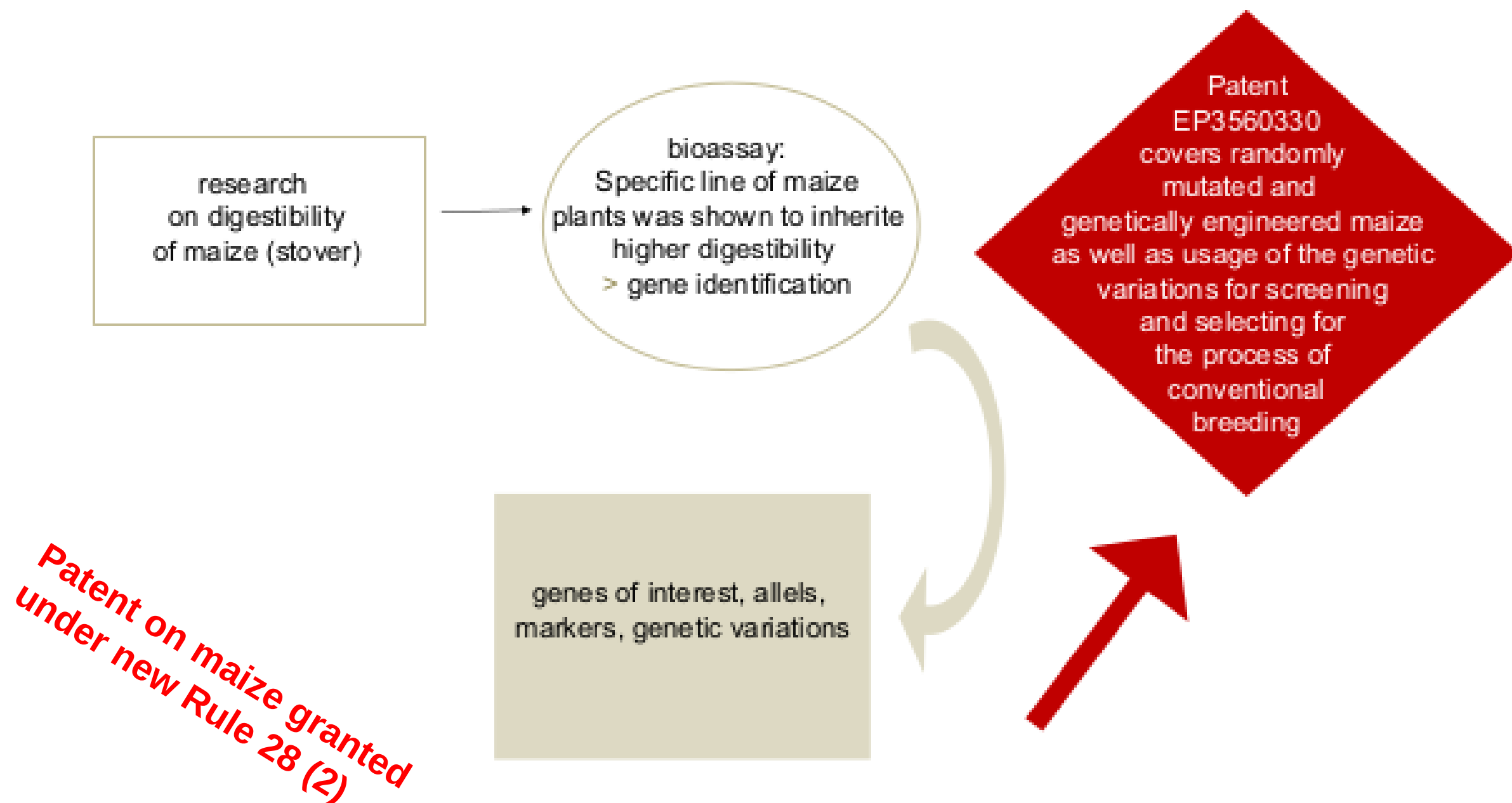


Figure 13: European patent EP 3560330 on randomly mutated maize and usage of naturally occurring genetic variations for the processes of plant conventional breeding, granted in 2022 (with disclaimer)

Legal background (1): Patents & technical inventions concerning plants

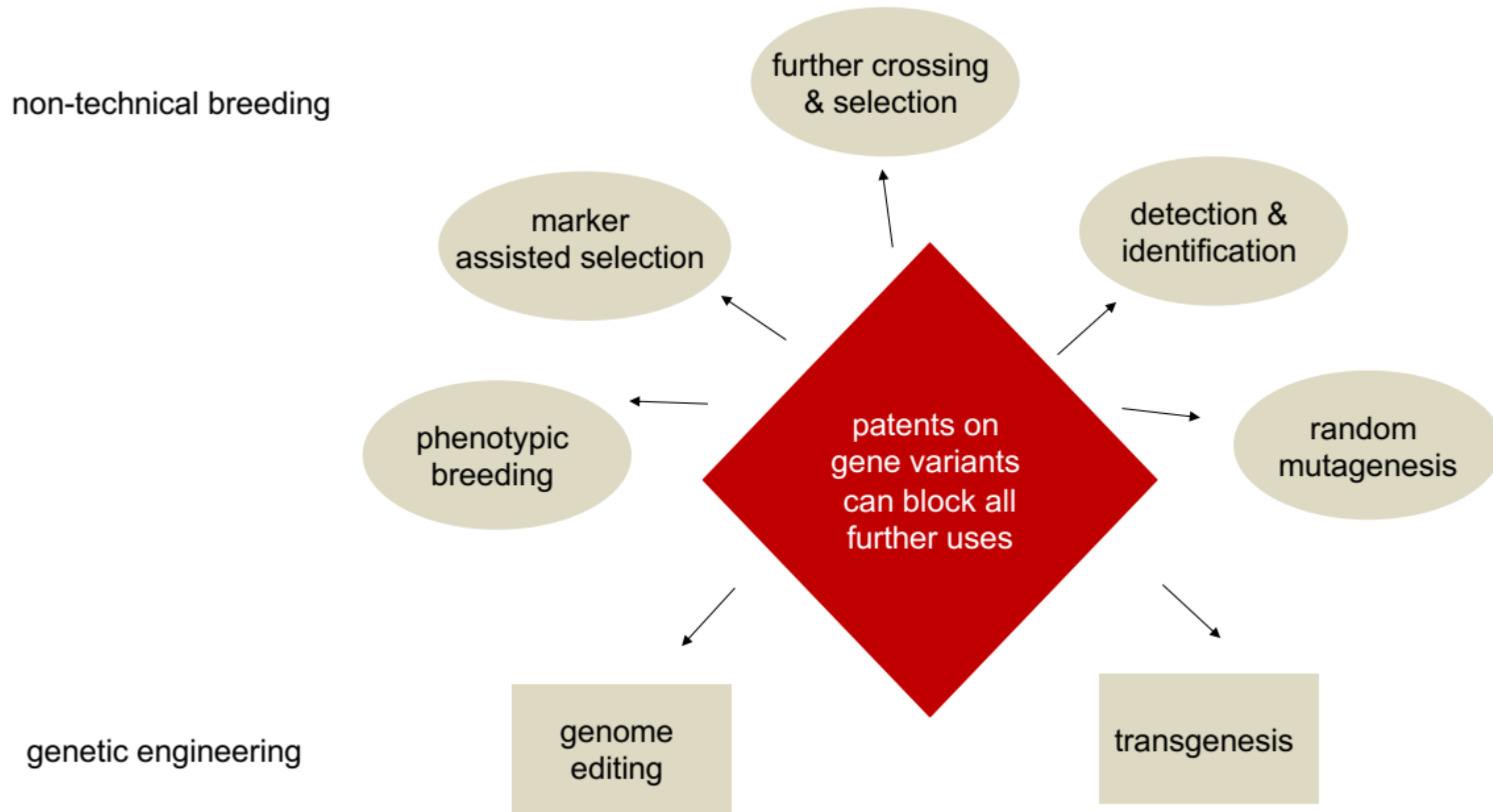
- EU patent directive 98/44 allowed patents on technical inventions concerning plants and animals (Art. 4.2) for the first time in Europe.
- This is in form of an exemption from Article 53 (b) of the European Patent Convention (EPC), which prohibits patents on plant varieties as well as on plant breeding based on essentially biological processes.
- The wording of EU directive (1999) and the historical background (EPC 1973) make it clear that the exemption from the prohibition is only applicable to plants derived from genetic engineering (including genome editing).
- Therefore, the prohibitions in Article 53 (b) are fully applicable to plants derived from essentially biological processes with outcomes that cannot be directly controlled by technical means, e.g. random mutations or crossing and selection.
- If patents on technological inventions are granted, the scope of the patents has to be restricted to the specific technical processes and any products thereof, so that conventional breeding is not affected.

Legal background (2): Patents & technical inventions concerning plants

- EU patent directive 98/44 also allowed patents on isolated genes (Art. 3.2) for the first time in Europe.
- However, genes which are introduced by crossing and selection from one variety to another within the same species cannot be regarded as technical inventions in the meaning within the EU Patent Directive. The same is true for gene variants resulting from random processes.

Discussion & Conclusions

Patents on plant genes can block all further uses of plants and genes



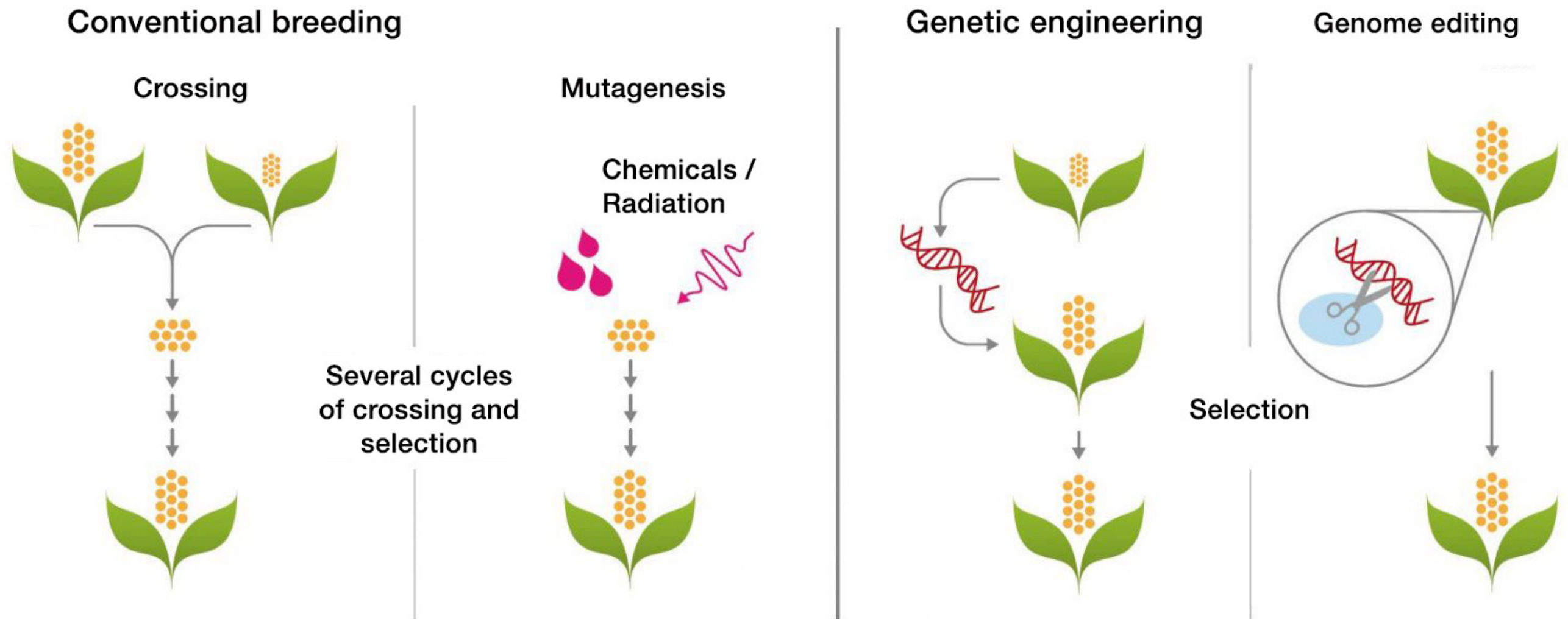


Figure 4: Differences between conventional breeding (including random mutagenesis) versus genetic engineering (including genome editing): conventional breeding always needs several cycles of crossing and selection to achieve to a desired trait, while GE can be used to directly insert new traits into a plant.

1. Definition of “essentially biological processes”

It has to be made clear that the term “essentially biological processes” covers all conventional breeding processes, including random mutagenesis, as well as all individual steps in the process, such as selection and / or propagation.

2. Definition of ‘products’ used or derived from breeding

It has to be made clear that all ‘products’ used in or emanating from ‘essentially biological processes’ are captured by the exclusion from patentability, including all plant/animal parts, cells and genetic information. Any usage of naturally existing genetic variations within the process of conventional plant breeding has to be excluded from patent claims.

3. Limiting the scope of protection

In the context of plant and animal breeding, the EPO must not grant “absolute product protection”, which enables a patent on a plant or animal derived from a technical process to be extended to all conventionally-bred plants with the same traits.